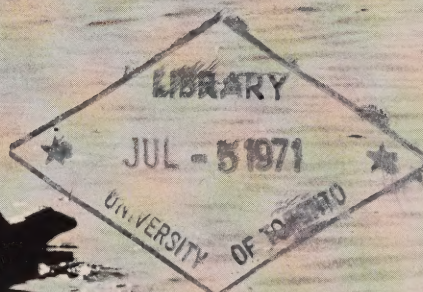


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Ontario Water Resources Commission 1969 Annual Report



Water management
in Ontario



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Ontario Water Resources Commission **1969 Annual Report**



ONTARIO WATER RESOURCES COMMISSION
OFFICE OF THE GENERAL MANAGER

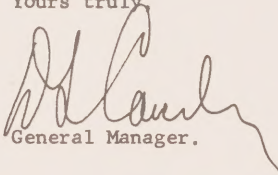
April 1, 1970

Mr. D. J. Collins,
Chairman,
Ontario Water Resources Commission,
135 St. Clair Avenue West,
Toronto 7, Ontario.

Dear Mr. Collins:

It is with pleasure that I present to you and the other members of the Ontario Water Resources Commission the Fourteenth Annual Report of the Commission.

Yours truly,


General Manager.



WATER RESOURCES COMMISSION

135 St. Clair Avenue West
Toronto 7, Ontario

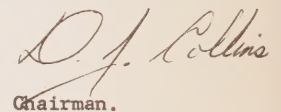
April 1, 1970

To: The Honourable G. A. Kerr,
Minister of Energy and Resources
Management.

Sir:

In conformity with and under the provisions of The Ontario Water Resources Commission Act, I have the honour to present to you the Fourteenth Annual Report of the Ontario Water Resources Commission.

Respectfully submitted,


Chairman.



Water management in Ontario

Ontario Water Resources Commission

D. J. Collins *Chairman*

J.H.H. Root *Vice-Chairman*

Commissioners

H. E. Brown

D. A. Moodie

L. E. Venchiarutti

W. S. MacDonnell *Commission Secretary*

M. Weissengruber *Assistant to the Chairman*

STAFF ORGANIZATION AS OF DECEMBER 31, 1969

General Manager D. S. Caverly

Assistant General Managers L. E. Owers, K. H. Sharpe,

F. A. Voegel, A. K. Watt

Assistant to the General Manager M. J. Cathcart

ADMINISTRATIVE BRANCHES

Public Relations and Information: Director M. F. Cheetham

Legal: Senior Solicitor H. Landis

Personnel: Director A.W.R. Uren

DIVISION OF ADMINISTRATIVE SERVICES

L. M. Tobias *Director*

DIVISION OF CONSTRUCTION

A. W. Shattuck *Director* J.C.F. MacDonald *Assistant Director*

DIVISION OF FINANCE

E. F. Heath *Comptroller and Director*

DIVISION OF INDUSTRIAL WASTES

D. P. Caplice *Director* H. A. Clarke *Assistant Director*

DIVISION OF LABORATORIES

J. H. Neil *Director*

DIVISION OF PLANT OPERATIONS

D. A. McTavish *Director* C. W. Perry *Assistant Director*

DIVISION OF PROJECT DEVELOPMENT

P. G. Cockburn *Director* L. F. Pitura *Assistant Director*

DIVISION OF RESEARCH

A. J. Harris *Director*

DIVISION OF SANITARY ENGINEERING

J. R. Barr *Director* G. R. Trewin *Assistant Director*

DIVISION OF WATER RESOURCES

K. E. Symons *Director* D. N. Jeffs *Assistant Director*

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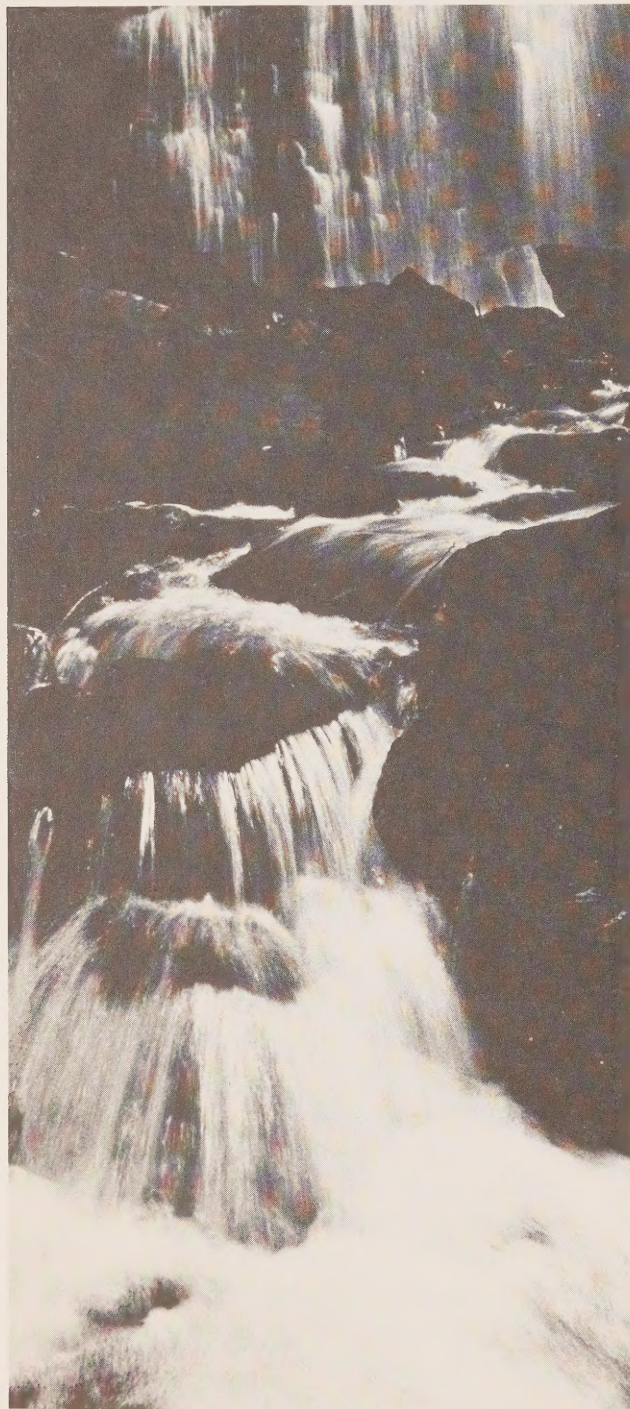
Water and Well Management Branch

Hydrologic Data Branch

River Basin Research Branch

Introduction

Few topics have received more public attention during 1969 than the subject of water pollution. The degree of interest which has been focussed upon this problem is unprecedented. In North America, as a whole, pollution became recognized as a major social and environmental concern. In 1969, a new Federal Canada Water Bill was



introduced. In the U.S.A., the 91st Congress progressively enacted the Water Quality Improvement Bill. In Ontario, provincial responsibility for all aspects of pollution control were centralized in one Ministry under the Honourable George Kerr, Q.C.

The increased activities of the Ontario Water Resources Commission in the field of water management reflect the support which the people of this Province are prepared to give to its programs. The priorities being established by municipality after municipality in the provision of water supply and sewage treatment facilities, in the face of other legitimate claims upon the tax dollar, are an indication that the people of Ontario are demanding programs which will restore and maintain a healthy environment.

For twelve years the Ontario Water Resources Commission, first under Chairman A. M. Snider, then under Chairman James A. Vance, pioneered many water management programs until it became one of the most effective water management agencies in North America. Most of these early programs were directed towards the correction of broad municipal water supply and sewage treatment problems. Comprehensive programs were undertaken, based on strong legislative powers which representatives from many countries have studied and used as a model. Since 1957, municipalities have established water and sewage works valued at approximately \$2 billion, as a result of which increased attention can now be given to industrial waste treatment problems and area planning of services.

The year 1969 has been a most active and creative one for the Ontario Water Resources Commission. A civil servant, Donald J. Collins, former Deputy Minister of Transport and Chairman of the Civil Service Commission for many years, was appointed the first full-time Chairman on April 1, 1969. He continued the major policies of his predecessors, and has instituted new procedures outlined in this report. By the year-end, the Chairman had attended 57 public meetings and 103 planning and discussion meetings, most of which involved municipal officials. Over 20 meetings with United States officials were attended by the Chairman as well.

The Commission considered and approved 65 projects, meeting 57 times during the course of the year. It met in Executive Session on alternate weeks to consider more routine administrative matters. Ninety-five other Commission sessions were held by the Chairman and Vice-Chairman as authorized under Section 8 of the Act. In addition, the Commission visited all parts of Ontario — from Windsor to Ottawa, Thunder Bay and Red Lake. The Chairman and staff also inspected remote northern locations which are included in the Commission's Northern Ontario Water Resources Study Program, now in its third year of inventory work.

Vice-Chairman John H. Root, M.P.P., held 38 OWRC Public Hearings and Information Meetings throughout the Province under the OWRC Act. Most of these concerned public acceptance of waste treatment proposals submitted

by industry or municipalities. In addition to his responsibilities as a Member of the Provincial Legislature, he represented the Commission at over 85 functions including official openings, interviews and meetings.

Commissioner Hugh E. Brown, a former Deputy Provincial Treasurer, continued as Chairman of the OWRC Investment Committee which is responsible for certain financial decisions involving OWRC capital funds. He also presided as non-voting Chairman of the important new South Peel Advisory Committee which has guided the Commission's largest area water and sewage project undertaken to date. This Committee is composed of elected representatives of the Municipalities of Mississauga, Streetsville, Brampton, Port Credit and the Township of Chingua-cousy.

Commissioners D. A. Moodie, former Reeve of the Township of Nepean, and L. E. Venchiarutti, Architect and Planner, also continued to make a valuable contribution to the Commission, participating fully in all formal meetings as well as attending many other meetings during the year on behalf of the OWRC.

Among several important Commission meetings held during the year, one of the most notable was a three-day session with senior staff on policy matters in order to provide new guidelines necessary for the increasing pace of Commission activity in meeting the Province's water supply and waste treatment requirements.

A major new policy was proposed by the Commission to the Government, and subsequently adopted, providing assistance to small municipalities in the construction of essential water supply and sewage treatment works. A municipality is eligible for assistance where the cost per typical home will exceed \$120.00 for sewage and \$100.00 for water. A subsidy of up to 50% of the total cost for the project may be paid, in order to keep costs to this level for the homeowner. A second new policy established a 15%

subsidy, subject to Treasury Board approval, with a view to providing for the oversizing of certain area works beyond current needs. This oversizing provision represents an investment on the part of the Province in ensuring the availability of services for future growth.

The number of projects accepted by the Commission in 1969 based on OWRC/Municipal agreement showed an increase over the previous year; 36 projects were initiated at an estimated cost in excess of \$8.5 million. Twenty-nine projects based on provincial ownership were accepted by the Commission during the year, bringing the number undertaken on this basis of financing, introduced in 1964/65, to 262. Included in this cumulative figure are a number of area programs. At the end of the year the Commission had 333 water and sewage works in operation in 207 municipalities in the Province.

Paralleling the increase in the number of projects undertaken by the OWRC in 1969 was a similar increase in those being developed by municipalities through their own financing. A total of 2,209 Certificates of Approval were issued by the Commission's Design Approvals Branch, for an estimated value of \$207.6 million.

Commitments for waste treatment facilities were obtained in 1969 from an increasing number of industries as well, including such major industries as pulp and paper, steel, manufacturing, chemical and petroleum. One hundred and sixteen Certificates of Approval were issued in 1969 for such facilities involving an estimated expenditure in excess of \$15 million. Programs involving the evaluation by the OWRC of the efficiency of industrial waste treatment facilities continued to expand as more industrial treatment works became operational.

Commission policy was clarified concerning the required participation of industry in municipal waste treatment systems except when exempted by the Commission. There was an increased use, during the year, by the Commission of



Current pattern checking near Nanticoke

Ministerial Orders to industry requiring the installation of waste treatment facilities, and prosecutions under the Act with respect to industries have increased.

The Commission again sponsored the annual Industrial Waste Conference, the 16th to be held to date. This Conference provides an important forum for discussions concerning the methods by which difficult industrial waste problems are being solved not only in Ontario but in other parts of the world.

Several major drainage basin studies were carried out in 1969 including the Rainy River, the Ottawa River and the Grand River. The Commission's regular monitoring and surveillance programs were carried forward, including the survey of the lower Great Lakes and the connecting rivers. The latter work is closely co-ordinated with similar work being carried out by the United States pollution control agencies. Jointly prepared reports are submitted to the International Joint Commission. Meetings were held with the United States Legislative Committee on Lake Erie to consider future action in controlling waste discharges to Lake Erie.

Ontario's Boating Regulation came into force on January 1, 1969. It is interesting to note that the State of Michigan has adopted a similar regulation and other border states are considering like action. During the course of the year some 1,765 pleasure craft were examined by OWRC staff for compliance with the Regulation. By the end of the 1969 boating season, 91 yacht clubs and marinas in Ontario were offering holding tank pump-out service.

Emphasis continues to be placed upon long-range planning with respect to the provision of water and sewage services in developing areas of the Province. A number of important studies of this nature are under way at the present time in co-operation with other government agencies. Meetings have been held between the Commission and the Department of Municipal Affairs concerning the relationship between the OWRC and newly-formed Regional Governments with respect to water and sewage services. There has been extensive participation on the part of the OWRC staff with respect to such bodies as the Sub-committee of the continuing Metropolitan Toronto and Region Transportation Study and the Haldimand-Norfolk Regional Services Planning Group.

Greater co-ordination and more effective liaison are being accomplished through discussions and study committees with other provincial government agencies such as the departments of Justice, Municipal Affairs, Agriculture and Food, Health, Lands and Forests, Labour, Education, Treasury and Economics and Energy and Resources Management. A liaison committee comprised of representatives of the Central Mortgage and Housing Corporation and the OWRC has been established to allocate the federal funds made available for the construction of sewage treatment works.

An important adjunct to the Commission's technical programs is its research and laboratory activities. A modern laboratory building provides analytical and research facilities designed to handle a wide range of water management problems. Increased emphasis has been placed on environ-



mental research, with a broader integration being effected of biological, bacteriological, chemical and engineering parameters. In early October, the Commission authorized the construction of a full-scale project for nutrient removal at a conventional sewage treatment plant. A new OWRC process based on lime precipitation will be utilized in this pilot study with a view to developing a comprehensive program of nutrient removal in the Province.

In its programs related to the management and assessment of the Province's ground and surface water resources, the Commission continued its involvement in a number of important surveys including projects being carried out under the Agricultural Rehabilitation and Development Acts, the International Hydrological Decade, and the International Field Year on the Great Lakes. The Northern Ontario water resources studies in 1969 included work on the Albany, the Winisk and the Severn river basins. Regular programs were carried out with respect to water resources services, test-drilling and well-construction projects, water permits and the collection and analysis of basic hydro-metric data.

This Annual Report has been assembled with a view to providing the reader with some indication of the diversified programs in which the Commission is engaged as it continues to fulfil its responsibility for water management in Ontario.

Public Relations and Information

M. F. Cheetham, Director

Following the results of a public awareness study late in 1968, the Commission embarked on a communications program that would more fully acquaint the general public with the OWRC and identify it with the water management programs in this Province. A re-assessment of staff duties within PR&I was carried out and a more fully integrated communications program was developed to achieve these objectives within the budget allocation.

The overall activities of PR&I were expanded to incorporate not only normal publicity functions but also several new aspects of public relations and communications. Activities in the communication fields include editorial, photo-film, education, exhibits, research and associated areas.

EDITORIAL

Eighty-five news releases were issued during the year, the majority being distributed on a regional basis to specifically concerned media, thereby resulting in greater coverage and more meaningful reporting on Commission activities in affected areas. In addition, all releases were circulated to vertical business publications, free-lance writers and others interested in the OWRC's water management programs.

Six issues of the Commission's internal-external tabloid newspaper "Watertalk" were printed and distributed. Cur-

rently, the external circulation of the tabloid numbers approximately 6,500 for each of the bi-monthly issues. Internally, all employees receive copies of Watertalk.

Eight feature articles for newspapers and business publications were prepared. Numerous articles were also extracted from various issues of Watertalk and reprinted in weekly newspapers and the business press.

A special advertisement series was developed regarding the introduction of the new Ontario Boating Regulation. Three advertisements were produced and inserted four times in fifteen newspapers and four boating publications. A supporting promotional program was also developed and included the production and printing of inspection decals, updated pump-out station charts, regulation digests and reprints of the advertisements for distribution at marinas and yacht clubs. Eight-three thousand units of these items were produced and distributed during the annual boat show and the summer boating season.

PHOTO-FILM

Film and photo activities also accelerated. In 1969 a 21-minute colour film "Teamwork" was produced as well as two television public service news clips, with prints being made available for distribution to TV stations in the



Counselling students in film production

Province. A news clip, which was produced in 1968, continued to be used throughout 1969, with most satisfying results. "Teamwork" is the third film that PR&I staff have produced since 1967. A fourth was also produced for the OWRC by an outside agency. An estimated 2,000 still photographs were taken for use in the photo files, exhibits, reports, publications, media requests and illustrated presentations on Commission activities.

PR&I maintains a film library which contains fifty-five prints of eight films available through this Commission's public relations service. In 1969 an estimated audience of 30,000 people (exclusive of TV viewers) saw OWRC films. In addition, 125 schools in the Province used OWRC films in their resource management educational programs.

EDUCATION

The educational aspects of PR&I's communications program continue to be developed. A staff member is devoting an increasing amount of time visiting schools and meeting with teachers and students to discuss water management. Over thirty schools were visited and nearly 6,000 students were addressed during 1969.

An indication of the increased interest in water management is also shown in the significant rise in publications circulation. In 1967, an estimated 300,000 pieces of literature were distributed by the Commission. In 1968, this number rose to 478,000 and, in 1969, the figure exceeded 700,000 individual pieces. Approximately 90% of this material is distributed to students and schools. Over 30 different publications on water management are available.

EXHIBITS

Exhibition activities were expanded in 1969 with six units being exhibited at nineteen locations. A new Resource and Exhibit Centre was opened in the Commission's head office main lobby toward the end of the year. For the first time, two exhibit teams travelled throughout the Province during the summer months, participating in smaller fairs as well as in the main regional exhibitions in which the Commission took part previously. Centres in which the Commission exhibited included the Lakehead, Peterborough, Belleville, Ottawa, Kitchener, Galt, London, Kingston, Lindsay, Welland, Sioux Lookout, Norfolk and Tillsonburg. The permanent exhibit continued at the government exhibit centre in Niagara Falls and portable units were also displayed at the Royal Winter Fair, the Boat Show, the Tobacco Growers Exhibition, and the Water Well Drillers conference.

Three plant opening ceremonies were held in 1969 at Cornwall, Beaverton and Pickering. An official opening of the Commission's regional office at the Lakehead was also arranged. "Open house" programs for the general public were staged at these centres. At Port Carling, a special open house for area residents and cottagers was held at the Commission's mobile laboratory which was located in the community as the operational headquarters for a study on the Muskoka Lakes.

RESEARCH

8 Towards the end of 1969, a further awareness study, similar

to the one carried out in 1968, was undertaken. Again, the objectives of the research project were: (a) to measure among the general public of Ontario, awareness of water pollution as a problem; (b) to measure the degree of concern among the general public about water pollution problems; (c) to measure awareness of the OWRC as a body actively engaged in combating water pollution problems; (d) to measure, in general terms, the degree of goodwill that now exists toward the OWRC. In addition, one further objective was added to the study this year, namely, to obtain a reading of the willingness of the Ontario public to contribute financially to the eradication of water pollution problems.

The results of this year's study showed some significant changes in the public's attitude. Unlike the 1968 study — when concern about the cost of living was highest, with concern about taxes and the cost of housing sharing second place with concern about water pollution — this year concern about water pollution stood out a clear second to the "rising cost of living".

The number of people who described themselves as "very concerned" about pollution was 72%, compared to 68% last year, with only 8% of all respondents indicating that they were not concerned about pollution. On an unaided basis, 18% of the respondents (compared to only 10% last year) were able to name the OWRC as the government organization at the provincial level responsible for water pollution abatement.

As a barometer of active concern, respondents were asked if they would be willing to accept an additional expense of \$50 a year per family to have water pollution reduced. While this type of concern has not been measured in Ontario before, there is some comparative information available: In November of 1966, 36% of the United States population on a similar survey answered "yes". The results of this survey, which indicated that 57% of the Ontario adult population answered "yes", would seem to indicate that concern is reaching a very active level in the Province.

The results of the 1969 study will be used by PR&I as benchmarks to formulate advertising and communications plans for the forthcoming year.

In addition to this specific study, research techniques and "readings" are also taken on advertisements, publications, films and other communication tools being used by PR&I to create an awareness of and support for the water management program in Ontario. Adjustments in the program are made according to the findings.

ASSOCIATED AREAS

In addition to the above specific areas of operation, PR&I personnel were also involved in a consultative capacity to agencies and groups whose activities are related to those of the Commission. These included the Canadian Institute on Pollution Control, the Ontario Municipal Water Association, the Ontario Plumbing Inspectors Association, the Lake Ontario Regional Development Council, various service clubs, educational institutions, journalists and film producers, and similar organizations or individuals having parallel interests.

The Commission again sponsored the Ontario Weekly Newspaper Association editorial contest for the best editorial on water resources in 1969. The entries were judged by OWNA's awards committee, with The Ridgeway Dominion having the winning editorial this year. An appropriate presentation is made to the winning editorial writer at the Association's annual meeting.

PR&I is also responsible for the editorial content, format and design of all Commission informational literature, displays, films and similar communication vehicles, as well as the placement of advertisements relating to public hearings, tender calls and other print notices respecting the operations of the Commission.



Student education program

The year 1969 was an active one for PR&I personnel. The extent of this activity is reflected in the number of contacts that were made with the general public by the staff. A total of 5,138 telephone calls, 15,810 mail enquiries and 2,460 personal visits were handled. Add to this the audiences reached through educational presentations, public speaking assignments, film shows and exhibition participation, and the total is difficult to estimate.

Indications are that 1970 will be an even more active year for those involved in carrying out the Commission's public relations and information program.

Legal Branch

H. Landis, Senior Solicitor

The Branch provides services of a legal nature to the Commission, its management and divisions. These services include the following:

- (1) Advising on the interpretation and/or revision of the OWRC Act and related legislation in the field of pollution control;
- (2) Drafting and revising contracts with municipalities, consultants, general contractors and others in the related fields of financing, construction and operation of sewage and water works;
- (3) Drafting requirements and directions to industrial and commercial establishments requiring the provision of facilities for treatment or pre-treatment of their wastes;
- (4) Drafting reports to municipalities to compel the provision of sewage works deemed by the Commission to be in the public interest;
- (5) Advising on litigation and prosecutions arising out of (2), (3) and (4); preparing briefs of facts and law in liaison with the Department of Justice and crown attorneys throughout the Province and providing information as required on pollution prosecutions of current public interest;
- (6) Maintaining liaison with federal, provincial and municipal authorities on legal aspects of the Commission's work.

LEGAL ACTIONS

In the field of prosecutions, three companies were convicted in 1969 on a total of five charges of impairment of water under section 27(1) of the Act. Charges are pending at the end of the year against seven other companies for a total of 12 offences under the same section. Two companies were convicted under section 31(1) for installing sewage works without approval. A trailer camp operator was convicted for failure to furnish information demanded by the Commission concerning its water system. A well driller was convicted for failure to submit water well records both to the Commission and to the owner concerned. One individual was convicted under the Boating Regulation and two charges under this Regulation were pending at the close of the year.

Requirements and directions were issued, with the Minister's approval, under section 50 in connection with three industrial establishments.

A formal report under section 38 was adopted at the close of the year, timed to coincide with the assumption of responsibilities by the new Regional Municipality of Niagara. This report which concerned sewage treatment required under the staged program of a local municipality was addressed jointly to the clerks of both the regional municipality and the municipality concerned, pending clarification of responsibility for sewage works to be assumed by the regional council.



Personnel Branch

A. R. W. Uren, Director

Recruitment, one of the primary functions of the Personnel Branch, continued as a very important activity. The normal turnover of staff required constant attention to find suitable replacements. Contact was maintained with the universities and technological schools through correspondence and the provision of suitable recruiting literature.

New positions and other vacancies that occurred at water treatment and pollution control centres were filled by competitions at 11 locations in Ontario. Information meetings were held with groups of municipal staff who transferred to the South Peel County Area water and sewage projects to inform them of the conditions of employment and opportunities offered to them as employees of the OWRC.

The applications from students for summer employment again greatly exceeded the requirements. On July 1, there were 190 students on summer casual staff of the Commission. These were mainly engineering, science and technology undergraduates, but some secondary school students were included. These were employed in supporting roles in the laboratories and the various field programs related to water resources management and pollution surveys.

The Commission has continued its participation in the University of Waterloo co-operative education program. A total of 27 students were employed, six serving two terms of four months each, and 21 working for one term.

Under the program of graduate training administered by the Branch, seven members of the professional staff were awarded bursaries and granted educational leave to take

graduate courses at Ontario universities. Four enrolled in sanitary and environmental engineering, and one in each of water resources management, water chemistry and biology. There was also active participation by staff at most levels in courses offered by the Staff Development Branch of the Department of Civil Service.

Forty-six members of staff applied for financial assistance to enroll in university extension or secondary school and technological evening courses related to their occupation. During the year, 34 of these members successfully completed approved courses and were reimbursed for the OWRC share of the cost of the course.

On December 31, 1969, the staff complement of the Commission was:

Head Office Organization	
Permanent and temporary	716
Seasonal casual	46
Provincial Works	
Permanent and temporary	92
Regular part-time	2
Casual	7
Plant Operations	
Permanent and temporary	218
Regular part-time	19
Casual	11

Division of Administrative Services

L. M. Tobias, Director

The Division of Administrative Services is responsible for systems design and computer programming and operation; the purchasing, storage and inventory control of goods and services; buildings management matters related to the two main offices and the laboratory in Toronto as well as the regional offices and facilities at Kingston, London, Sudbury (sub office) and the Lakehead; the maintaining of files and records and the administration of the Commission's records management program.

A number of meetings and discussions were held during the year with staff of the Advisory Services Division of the Treasury Board in connection with the Commission's proposal to use data transmission facilities which are connected to the Department of Highways Computing Centre. Early in the year, on the instructions of the Treasury Board, the Commission changed over from the IBM Data Centre to the Department of Highways Computing Branch. This involved a number of complex problems, but with the assistance of staff at the Department of Highways and at IBM it was successfully accomplished. In collaboration with the Director of the Department of Highways Computing Branch, an Operating Agreement was designed to facilitate the processing of OWRC material on that computer.

Advisory Services Division of the Treasury Board provided assistance to Commission staff in considering the use of various computer time-sharing devices which, when connected to a computer, can be used for solving complex engineering problems and can also be used to great advantage by programmers in the writing and testing of new computer programs.

Most of the systems design and computer-oriented projects to be dealt with involve the handling of information of a technical, engineering or scientific nature. Emphasis is being placed on these technical applications so that, together, they may form a firm basis for the Commission's Water Quality Management Information System. Senior management established priorities for dealing with these various applications and a policy was adopted to govern the methods in which new computer applications can be developed.

The increasing volume and complexity of sample analyses results being handled by the Division of Laboratories was the subject of study to determine whether some changed system of information handling would better serve the needs of that Division. The possibility of automating the production of analyses results, together with the processing of information being generated by automatic testing equipment now at the Laboratory, is under review.

An evaluation was conducted into various types of photocopying equipment in order to minimize breakdown time, to improve the speed and efficiency of operation, and particularly to reduce costs.

Various changes in purchasing procedures were made in order to expedite and simplify the acquisition of goods, materials and services for the divisions of Laboratories and Research, and for the Division of Plant Operations at OWRC water and sewage projects.

During the course of the year it was necessary to obtain additional storage space for bulk supplies and field equipment. Warehouse space is maintained at two locations in the Borough of North York close to the laboratory building. These facilities are used for the storage of bulk materials and marine and field equipment.

The Commission made a formal beginning on a Records Management Program by establishing retention and disposal schedules for some of its records. A total of 1,450 cubic feet of records is accommodated at the Cooksville Retention Centre and retention and disposal schedules were established for 13 records series involving the divisions of Administrative Services, Sanitary Engineering and Industrial Wastes.

The Commission's head office relocation from 801 and 880 Bay Street to 135 and 40 St. Clair Avenue West, respectively, was co-ordinated and successfully completed early in the year. The Commissioners, the General Manager's office, the Commission Secretary and the divisions of Finance, Industrial Wastes, Project Development, Construction, Sanitary Engineering and Administrative Services, together with the Legal, Public Relations and Information and Personnel branches were accommodated at 135 St. Clair Avenue West. The divisions of Plant Operations and Water Resources were located at 40 St. Clair Avenue West. The divisions of Laboratories and Research remained at the Laboratory building on Highway No. 401 at Islington Avenue in Etobicoke.

Renovations were completed in the rented space at Fort William to accommodate the Lakehead Regional Office and Laboratory. Rented space was located in Sudbury to accommodate a small staff in a sub-office established there. With the existing separate accommodation for the regional office and the regional laboratory in London becoming inadequate it was decided to search for suitable space large enough to accommodate the office and laboratory in one building.

Agreement was reached with the Buildings Management Branch of the Department of Public Works in connection with the sharing of responsibility for maintenance of the OWRC Laboratory building.

All buildings management matters involving the repairs, reconstruction of offices and other physical services were co-ordinated with various branches of the Department of Public Works. The successful execution of this work is in large measure due to the excellent co-operation received from that Department.

The 16th Ontario Industrial Waste Conference held in Niagara Falls, Ontario, in June, was highly successful. This conference, dealing with the problems of industrial wastes, attracted over 300 senior officials representing the three levels of government, consulting engineers, manufacturing industries, equipment suppliers, universities and others. The delegates came from all provinces of Canada and from a number of the United States.

A more detailed account of the activities of each of the branches which make up the Division follows.

SYSTEMS AND EDP BRANCH

The Systems and EDP Branch is comprised of three sections, (a) Systems and Programming, (b) Data Control, and (c) Key Punch. The Systems and Programming Section conducts the evaluation, design, programming and implementation of system changes as warranted. The Data Control Section performs the editing, scheduling and control of source data and job programs which go into the daily stream of computer processing. The Key Punch Section is responsible for the converting and the verifying of source data into machine readable input.

In 1969 the Branch was involved in a variety of projects involving both water quality management and accounting applications. Some of the projects implemented and now in operation are described below:

A River Basins Water Quality Monitoring System was developed to provide monthly detailed reports on approximately seven hundred sampling stations in nineteen terminal river basins. A parallel system was developed for the processing of water quality information from intensive surveys of some basins.

A reporting system was designed to process flow data from current meters located in two lakes. Five self-contained integral recording meters, measuring various quantitative parameters, were operated continuously from May to November in Lake Ontario and Lake Erie. The readings, coded on magnetic tape, were processed to produce statistical reports and mathematical dispersion model information.

A Monthly Operating Expenditure Statement System was implemented to assist the Division of Plant Operations in the budget-cost control functions associated with the operation of OWRC water and sewage treatment plants.

A Project Development Rate Calculation Program was written and implemented in early 1969 to compute rates to be charged to municipalities involved in provincially-owned water and sewage works. An additional program to accommodate changes in financing policy is currently under development and due for implementation in the first quarter of 1970.

Two programs were developed to assist in the interpretation and evaluation of streamflow data.

SUPPLY BRANCH

The Supply Branch is responsible (a) for the purchasing and acquisition of the goods, materials and services required by the Commission at its head office and laboratory locations, as well as at its various water and sewage projects located throughout Ontario; (b) for the storage and dispersal of office and technical supplies at the main head office and laboratory locations, for the operation of two warehouses where bulk supplies, marine equipment and other rolling stock are stored, and for supplying of regional offices and laboratories with materials necessary for their operation; and (c) for the processing of invoices from suppliers for payment and the control of inventory at head office and at OWRC projects.

Continuing attempts are made to streamline the methods and procedures used to effect economies and to expedite the provision of these services.

Details of the year's activities by each section are provided as follows:

Purchasing

The following comparison is provided of purchasing activity between 1968 and 1970 with respect to orders processed and mailed:

	1968		1969	
	No. of Orders	Value	No. of Orders	Value
Ordinary	5,564	\$ 2,555,797.56	5,094	\$ 1,647,933.08
Operating	4,329	694,945.66	4,725	711,377.02
Capital	537	17,033,140.41	465	56,304,011.16
Total	10,430	\$20,283,883.63	10,284	\$58,663,321.26

Staff processed 17,061 debits and credits in 1969 on the Operating Vote, compared with 9,655 in 1968. In addition, staff processed 8,857 debits and credits on the Ordinary Vote in 1969 compared with 8,284 in 1968.

Stores

Receiving Section	1966	1967	1968	1969
Incoming Shipments	13,619	15,011	13,705	12,765
Incoming Packages	20,273	23,320	20,940	20,396
Incoming Samples	72,488	98,571	91,991	94,915

Water samples received at the main Laboratories increased slightly despite the routing of more samples to the London Laboratory and the new Lakehead Regional Laboratory.

Payments for express shipments increased from about \$10,000 to \$12,000 but this increase is nominal, considering that express rates were increased by a minimum of 50c per shipment in May 1969. Costs were reduced by converting the 32 oz. capacity sample bottles from the previous 40 oz. size.

The reduction in Incoming Shipments and Packages reflects the utilization of annual type stock purchases and the efforts made to hold the line on costs in a period of considerable inflation.

Shipping Section

	1966	1967	1968	1969
Outgoing Shipments	5,272	7,518	5,867	5,315
Outgoing Packages	13,503	15,302	13,566	12,224
Outgoing Bottles	90,445	99,361	94,954	96,325

Plant operators and field staff cooperated in establishing regional stockpiles, making possible bulk shipments. This, in turn, effected a reduction in shipping costs and storage needs at the main laboratories.

Glassware Processing

	1966	1967	1968	1969
Machine Loads	2,978	3,499	2,920	3,017

Glassware volume remained fairly stable but the content was changed since new laboratory techniques have led to a greater variety in the type of glassware used, together with different washing and sterilization techniques with tighter quality control.

Chemical Stores

The number of different chemicals stocked increased from 244 to 363 to meet the needs of new, automated laboratory techniques. The quality of chemicals became more significant because of sensitive and expensive testing equipment now in use.

Many bulk acids and solvents are now stored at the Chesswood Warehouse because of laboratory space limitations. This arrangement makes possible more economical quantity purchases and avoids stockouts occasioned by prolonged and unreliable vendor deliveries.

Small Equipment and Linen Store

	1966	1967	1968	1969
Requisitions Filled	1,703	2,011	1,826	2,600

Requests for loans and transfers of small equipment showed an upward trend due to the increased use of boats and the expanded field work of the River Basins Branch. Use of tracing dyes and chemical engineering kits increased considerably.

First Aid and Safety

There was a substantial increase in staff receiving first aid treatment. Two cyanide antidote kits were obtained and staff were instructed in their use for emergencies.

Budget and Expenditures

The value of new equipment and supplies received by Stores totalled \$779,406 compared with \$648,422 in 1968.

Mail and Messenger Service

	1965	1968	1969
Outgoing Mail	118,925	199,153	232,580

Mail processing has doubled over a four year period.

Preparing and mailing parcels has tripled in the same period, increasing from 1,043 to 3,771 pieces. Much of the increase is due to the enlarged activities of the Public Relations and Information Branch.

As a result of the move of the Commission's offices from Bay Street to the two locations on St. Clair Avenue West, mail delivery routes have been lengthened both within and between the buildings.

Stationery Stockroom

	1965	1968	1969
Requisitions	4,414	13,013	14,589

It will be noted that requisitions have more than tripled in four years in the Stockroom. Considerable changes were effected in stockroom shelving and stock arrangements to obtain greater efficiency and simplicity.

CENTRAL RECORDS

During 1969 there were approximately 200,000 pieces of correspondence received by Central Records for processing. Files related to the Sudbury and Lakehead areas were duplicated for the Sudbury sub-office and the Lakehead Regional Office, respectively.

Towards the end of 1969 negotiations were started to schedule the industrial waste trade files and the sub-division files for transfer to the Cooksville Retention Centre in the early part of 1970.

The following material was separated, checked and packed into boxes for transfer:

Administrative Matters	—	1966 & 1967	29 cu.ft.
Municipal Files	—	1966 & 1967	26 cu.ft.
Analysis Files	—	1966 & 1967	26 cu.ft.
Sewage Approval Files	—	1967	55 cu.ft.
Water Approval Files	—	1967	22 cu.ft.
		Total	158 cu.ft.



Division of Construction

A. Shattuck, Director

J. C. F. Macdonald, Assistant Director

The Division of Construction is responsible for the administration of contracts let by the Commission for the construction of water works or sewage works to be undertaken as Commission-financed projects for municipalities or groups of municipalities. This involves overall supervision of work carried out by consulting engineers and contractors.

The Division is involved, together with certain other divisions, during the design stage of projects in the review of reports, proposals for equipment, and plans and specifications submitted by the consulting engineers.

Project Engineers of the Division make frequent on-site inspections of Commission projects which are under construction and investigate any problems which arise.

Technicians of the Division carry out testing of sewers and watermains and make photographic inspections of the interior of sewers on certain projects.

During 1969 the Commission entered into 36 contracts valued at \$20,231,185, of which \$10,368,784 was for water works and \$9,862,401 was for sewage works.

During the year 34 contracts were completed. These had a total value of \$10,369,632 and consisted of 15 water works totalling \$3,634,600, 14 sewage works totalling \$5,007,397 and five contracts covering both sewage works and water works totalling \$1,727,635.

Indications at the end of 1969 were that the number and total value of Commission projects under design or construction would increase substantially in 1970.



The following is a summary of projects which were under construction during 1969:

BEETON (1-0006-66 & 2-0220-67)

Description of Project: Sewerage system including sanitary sewers, services, factory-built pumping station, forcemain and sewage lagoons.

Consulting Engineers: Triton Engineering Services Ltd., Orangeville.

Completed: March 17, 1969.

Final Project Cost: \$409,500.00

BRAMPTON (6-0186-68)

Description of Project: 24-inch diameter watermain.

Consulting Engineers: W. O. Chisholm & Associates Ltd., Scarborough.

Completed: August 22, 1969.

Final Project Cost: \$227,700.00

BURLINGTON (2-0241-68)

Description of Project: Extension to Skyway water pollution control plant.

Consulting Engineers: James F. MacLaren Ltd., Toronto.

Expected Completion Date: March 1970.

Estimated Project Cost: \$662,000.00

Work commenced on February 24, 1969 and proceeded on schedule up to the time of the labour dispute in mid-summer. The dispute continued for 5½ months which delayed the project. Additional steelwork was needed to support the roof of the grit building as the block walls were in a worse condition than at first believed.

TOWNSHIP OF CLARENCE (Bourget) (6-0176-67)

Description of Project: Water distribution system, including one booster pump.

Consulting Engineers: J. L. Richards & Associates Ltd., Ottawa.

Completed: July 31, 1969.

Final Project Cost: \$111,579.00.

COOKSTOWN (6-0182-68)

Description of Project: Extensions to existing water distribution system.

Consulting Engineer: W. D. Beckett, Sarnia.

Completed: April 14, 1969.

Final Project Cost: \$12,500.00

CONESTOGO RIVER POLLUTION CONTROL SYSTEM No. 2 (1-0093-67)

Description of Project: Extensions to the existing sanitary sewerage system in the Village of Arthur.

Consulting Engineers: Philips & Roberts Ltd., Burlington.

Expected Completion Date: February 1970.

Estimated Project Cost: \$397,000.00

The contractor started work in August 1969, and by the end of the year had installed all of the sewers. The Wells Street pumping station was in use but it was not quite finished by the end of the year. The alterations to the existing Frederick Street pumping station are expected to be finished in February. Restoration of some streets will have to be carried out in the spring of 1970.

CORNWALL (2-0244-68)

Description of Project: Contract 20 — Fly Creek combined relief sewer. Estimated contract cost — \$723,000.00.

Consulting Engineers: Gore & Storrie Ltd., Toronto.

Expected Completion Date: March 1970.

Estimated Project Cost: \$1,002,000.00

Work commenced in June 1969 and by the end of the year was approximately 95% completed.

TOWNSHIP OF CUMBERLAND (2-0187-67)

Description of Project: 36-inch diameter trunk sewer.

Consulting Engineers: J. L. Richards & Associates Ltd., Ottawa

Completed: November 1, 1969.

Estimated Project Cost: \$101,000.00.

TOWNSHIP OF CUMBERLAND (2-0190-67)

Description of Project: Primary sewage treatment plant of 0.8 M. G. D. capacity.

Consulting Engineers: J. L. Richards & Associates Ltd., Ottawa.

Completed: October 24, 1969.

Estimated Project Cost: \$374,000.00.

DETROIT RIVER WATER WORKS SYSTEM (5-0026-66)

Description of Project: A system of treatment, distribution and storage of water to supply the Town of Amherstburg, the Township of Anderdon and the Township of Malden.

Consulting Engineers: C. G. Russell Armstrong Associates Ltd., Windsor.

Contract 1 — 500,000 Imperial gallon elevated tank. Estimated contract cost — \$206,000.00. Expected completion date — February 1970.

The tank has been chlorinated and tested and will be in service early in 1970.

Contract 2 — Trunk watermain. Estimated contract cost — \$584,325.00. Expected completion date — February 1970.

Following hydraulic testing and chlorination, the mains will be placed in service early in 1970.

Contract 3 — Water treatment plant. Estimated contract cost — \$1,695,000.00.

Tenders are expected to be called in February 1970.

Estimated Project Cost: \$3,188,541.00

The complete undertaking will not be in operation until 1971 but some benefit will be derived during 1970 due to the storage provided by the elevated tank.

DUFFIN'S CREEK POLLUTION CONTROL SYSTEM (1-0015-66)

Description of Project: Sewage treatment plant and sewerage in the Village of Pickering.

Consulting Engineer: Gore & Storrie Ltd., Toronto.

Contract 1 — Trunk sewer, sewage treatment plant and outlet sewer to Duffin's Creek. Final contract cost — \$595,295.00. Completed — June 24, 1969.

Contract 2 — Sewage pumping station, forcemain and sewage collector system. Final contract cost — \$636,767.00. Completed — February 7, 1969.

Final Project Cost: \$1,435,350.00.

ENGLISH RIVER POLLUTION CONTROL SYSTEM NO. 1 (1-0061-67)

ENGLISH RIVER WATER SUPPLY SYSTEM (5-0031-67)

Description of Project: Construction of municipal facilities in the Townsite of Ear Falls.

Consulting Engineers: Proctor & Redfern Ltd., Toronto.

Contract 1 (cost plus) — Development of a new townsite including sewers, watermain, a permanent water pumping station and temporary sewage settling tank. Final contract cost — \$1,225,459.00. Completed — September 1968.

Contract 2 — Cancelled.

Contract 3 — Addition of 22 units for the mobile home site. Estimated contract cost — \$55,440.00. Completed — December 1969.

Work on this contract started in August 1969 and was completed in December 1969 with the exception of grading and landscaping deferred to the spring of 1970.

Estimated Project Cost: \$1,636,000.00.

TOWNSHIP OF ERNESTOWN (6-0170-67, 2-0227-67, 2-0270-69)

Description of Project: Watermain, sanitary sewers, factory-built sewage pumping station and one additional lagoon cell.

Consulting Engineers: J. D. Lee Engineering Ltd., Kingston.

Expected Completion Date: September 1970.

Estimated Project Cost: \$970,000.00.

Work started in August 1969 and by the end of the year was approximately 30% completed. Some of the new sewers which have been tied into the existing system have been put into operation.

FRANKFORD (2-0223-67, 6-0168-67)

Description of Project: Extensions to sewers and watermain.

Consulting Engineers: DeLeuw, Cather & Co. of Canada Ltd., Toronto.

Completed: June 24, 1969.

Estimated Project Cost: \$159,100.00.

GRAND BEND (6-0165-66, 6-0194-67)

Description of Project: Water distribution system.

Consulting Engineers: P. T. Mitches & Associates Ltd., London.

Completed: July 16, 1969.

Final Project Cost: \$425,871.00.

HARRISTON (2-0242-68)

Description of Project: Extension to the existing sanitary sewerage system.

Consulting Engineers: B. M. Ross and Associates Ltd., Goderich.

Completed: August 12, 1969.

Final Project Cost: \$133,500.00.

TOWNSHIP OF KING (Oak Ridges) (6-0061-60)

Description of Project: Relocation of watermain.

Consulting Engineers: Totten, Sims, Hubicki & Associates Ltd., Whitby.

Completed: March 14, 1969.

Final Project Cost: \$36,713.00.

This work was done for Department of Highways road-widening purposes and the Department shared in the project costs in the ratio of 53:60 of the total cost.

TOWNSHIP OF KING (Oak Ridges) (6-0180-68)

Description of Project: Well and pumping station.

Consulting Engineers: Totten, Sims, Hubicki & Associates Ltd., Whitby.

Expected Completion Date: August 1970.

Estimated Project Cost: \$127,000.00.

The contract was awarded on December 1, 1969 but work is not expected to start until February 1970 when delivery of water treatment equipment will be made.

TOWNSHIP OF KING (Schomberg) (6-0177-68)

Description of Project: Well, connecting pipework.

Consulting Engineers: Totten, Sims, Hubicki & Associates Ltd., Whitby.

Completed: June 24, 1969.

Final Project Cost: \$6,532.00.

KITCHENER (6-0178-68)

Description of Project: 6 m. g. d. reservoir extension and booster pumping station at the Mannheim Reservoir.

Consulting Engineers: Proctor & Redfern Ltd., Toronto.

Completed: January 9, 1969.

Final Project Cost: \$390,186.00.

LAKE ERIE WATER SUPPLY SYSTEM (5-0002-65)

Description of Project: Water supply system from Lake Erie to the St. Thomas area.

Consulting Engineers: James F. MacLaren Ltd., Toronto.

Contracts 1 to 5, 8 and 9 — Completed prior to 1969.

Contract 6 — Water treatment plant. Estimated contract cost — \$3,694,000.00. Expected completion date — May 1971.

Tenders were opened on September 25, 1969 and the order to commence work was issued on November 10, 1969. By the end of the year 90% of the excavation had been completed and installation of the plant drain and yard piping commenced.

Purchase orders for the equipment to be supplied by the Commission were issued at the end of October 1969.

Estimated Project Cost: \$11,600,000.00.

LAKE HURON WATER SUPPLY SYSTEM (5-0005-66) Secondary supply facilities — Town of Parkhill.

Consulting Engineers: James F. MacLaren Ltd., Toronto.

Contract 1 — 100,000 gallon concrete reservoir. Estimated contract cost — \$100,600.00. Expected completion date — March 1970.

The order to commence work was given September 29, 1969. By the end of the year the structure had been completed and the inlet and outlet yard piping had been installed. A temporary by-pass to feed the 10-inch diameter pipeline to Parkhill had also been completed.

Contract 2 — 36,000 lineal feet of 10-inch diameter water pipeline. Estimated contract cost — \$289,700.00. Expected completion date — April 1970.

The order to commence work was given September 29, 1969. By the end of the year the entire length of the pipeline had been installed, tested and disinfected and was ready to be put into use. Restoration along the pipeline easement will be completed in the spring of 1970.

Estimated Project Cost: \$455,000.00.

LAKE HURON WATER SUPPLY SYSTEM (5-0043-67) Secondary supply facilities — Village of Ilderton.

Description of Project: 100,000 gallon concrete reservoir and pumping station.

Consulting Engineers: James F. MacLaren Ltd., London.

Completed: August 15, 1969.

Final Project Cost: \$154,500.00.

LAKE HURON WATER SUPPLY SYSTEM (5-0018-66) Secondary supply facilities — Village of Grand Bend.

Description of Project: 12,500 lineal feet of 14-inch diameter water pipeline.

Consulting Engineers: James F. MacLaren Ltd., London.

Completed: September 22, 1969.

Final Project Cost: \$248,265.52.

LAKE SIMCOE POLLUTION CONTROL SYSTEM NO. 1 (1-0008-66)

Description of Project: Sewers, pumping station, forcemain and waste stabilization ponds to serve the Village of Beaverton.

Consulting Engineers: W. O. Chisholm & Associates Ltd., Scarborough.

Completed: September 19, 1969.

Final Project Cost: \$913,700.00.



Brantford water pollution control plant

LAKE TIMISKAMING POLLUTION CONTROL SYSTEM NO. 2
(1-0094-67)
LAKE TIMISKAMING TERTIARY WATER SUPPLY SYSTEM
(5-0051-67)

Description of Project: Sanitary sewers, pumping stations, lagoon and water distribution system to serve the Township of Bucke.

Consulting Engineers: Sutcliffe Co., New Liskeard.

Expected Completion Date: January 1971.

Estimated Project Cost: \$632,000.00.

LAKE TIMISKAMING SECONDARY WATER SUPPLY SYSTEM
(5-0099-69)

Description of Project: A water supply system to serve the Town of Haileybury and the Township of Bucke.

Consulting Engineers: Canadian Mitchell Associates Ltd., Bramalea.

Contract A — Water treatment plant and water intake. Estimated contract cost — \$860,000.00.

This phase is still under design. It is expected that tenders will be called in February 1970.

Contract B — 400,000 gallon reservoir and pumping station. Expected completion date — December 1970. Estimated contract cost — \$262,681.00.

Work started in December 1969 and consisted of site clearing and earth excavation for the reservoir.

Contract C — 10-inch trunk distribution main from reservoir to North Cobalt. Expected completion date — September 1970. Estimated contract cost — \$125,334.00.

The contract was awarded in November 1969 but work will not start until the spring of 1970.

Estimated Project Cost: \$1,430,000.00.

LISTOWEL (2-0253-68)

Description of Project: Extensions to the sanitary sewer system.

Consulting Engineers: Peter T. Mitches & Associates Ltd., London.

Expected Completion Date: March 1970.

Estimated Project Cost: \$392,000.00.

Work commenced on October 21, 1969 and has continued at a good pace although the contractor has fallen behind schedule due to difficult ground conditions.

VILLAGE OF MARKHAM (2-0224-67)

Description of Project: Extension to the existing sewage treatment plant.

Consulting Engineers: R. V. Anderson Associates Ltd., Toronto.

Completed: January 31, 1969.

Final Project Cost: \$306,045.00.

MOOSE RIVER POLLUTION CONTROL SYSTEM NO. 1
(1-0002-66)
MOOSE RIVER WATER SUPPLY SYSTEM NO. 1 (5-0004-66)

Description of Project: Sewage works, water works and road works in the Moosonee Development Area.

Consulting Engineers: Sutcliffe Co., New Liskeard.

Contracts 1 to 4 — Completed prior to 1969.

Contract 5 — Extension of sanitary sewers, watermains and roadways. Estimated contract cost — \$245,176.00. Completed — October 22, 1969.

Contract 6 — Roadway and twin structural plate culverts crossing Store Creek. Estimated contract cost — \$46,119.00.

Due to the failure of the banks of the creek as a result of the contractor's operations, the project was not completed. Alternative means of crossing the creek are being investigated.

Estimated Project Cost: \$2,500,000.00.

TOWNSHIP OF MOUNTJOY (2-0195-65)

Description of Project: Sewage works for the area adjacent to Timmins.

Consulting Engineers: Gore & Storrie Ltd., Toronto.

Contract 1 — Sanitary sewers, factory-built sewage pumping station and forcemain. Estimated contract cost — \$149,000.00.

Never satisfactorily completed.

Contract 2 — Rectification of faulty sewers installed under Contract 1. Estimated contract cost — \$146,000.00. Completed — October 18, 1969.

Tenders for Contract 2 were received in July 1969 and the selected contractor commenced the rectification work in mid-August. It was found necessary to relay and repair considerably more of the sanitary sewers than had been anticipated and the cost of the rectification contract was much higher than expected. A claim will be made in due course against the bonding company of the contractor on Contract 1.

TOWNSHIP OF NEEBING (6-0172-67)

Description of Project: Approximately 30,000 feet of 6, 12, 18 and 24-inch diameter watermains.

Consulting Engineers: W. L. Wardrop & Associates Ltd., Thunder Bay.

Completed: December 23, 1969.

Estimated Project Cost: \$800,000.00

Work commenced in May and was completed in December 1969.

PORT COLBORNE (2-0243-68)

Description of Project: Rosemount Area sewerage.

Consulting Engineers: Canadian-British Engineering Consultants Ltd., Port Colborne..

Contract A — Three sewage pumping stations, Estimated contract cost — \$313,240.00. Expected completion date — August 1970.

The order to commence work was given November 17, 1969. Fabrication of the sewage pumping stations commenced at the supplier's factory. Excavation commenced for the Rosemount South sewage pumping station.

Contract B — Sanitary sewers and forcemains, Estimated contract cost — \$1,006,800.00. Expected completion date — November 1970.

The order to commence work was given November 17, 1969. Drilling and blasting of rock for the sewers on Sugar Loaf St. and Scholfield Dr. commenced but no pipe had been laid by the end of the year.

Contract C — Sanitary sewers and forcemain, Estimated contract cost — \$207,000.00. Expected completion date — November 1970.

The order to commence work was given on November 17, 1969. By the end of the year about 600 lineal feet of 8-inch diameter sewer had been laid on Tennessee Drive and pipelaying had commenced on Block A Street.

Estimated Project Cost: \$1,800,000.00.

SKOOKUM BAY WATER SUPPLY SYSTEM (5-0014-66) HOWEY BAY POLLUTION CONTROL SYSTEM (1-0040-66)

Description of Project: A complete sewage works system and a complete water works system for the Township of Red Lake.

Consulting Engineers: W. L. Wardrop & Associates Ltd., Winnipeg.

Completed: October 1, 1969.

Estimated Project Cost: \$1,555,000.00

This project was completed two months later than the date stipulated in the liberal extension of time previously granted. The project took more than two years to complete and exceeded the originally estimated cost. The contractor has lodged a substantial claim against the Commission on this project and this may have to be settled by litigation.

ST. LAWRENCE RIVER POLLUTION CONTROL SYSTEM NO. 1 (1-0001-66)

Description of Project: Sewage works in the City of Cornwall.

Consulting Engineers: Gore & Storrie Ltd., Toronto.

Contract 5 — Riverfront interceptor sewer. Final contract cost — \$2,724,400.00. Completed — December 16, 1968.

Contract 6 — Water pollution control plant. Final contract cost — \$1,351,060.00. Completed — February 28, 1969.

Contract 7 — Sewage pumping station. Final contract cost — \$656,463.00. Completed — February 28, 1969.

Contract 8 — Outfall to St. Lawrence River. Final contract cost — \$219,840.00. Completed — December 15, 1967.

Final Project Cost: \$5,450,325.00.

SOUTH PEEL AREA WATER PROJECTS (5-0020-66) (The numbers below indicate the sub-projects)

-01: 48-inch diameter feedermain, 2nd Line E., Hanlan to Becket-Sproule.

Consulting Engineers: Proctor & Redfern Ltd., Toronto.

Completed: November 5, 1969.

Final Project Cost: \$1,283,218.00.

-02: Lakeview water purification plant.

Consulting Engineers: Gore & Storrie Ltd., Toronto.

Contract 3 — Filters No. 11-18. Estimated contract cost — \$2,400,000.00. Expected completion date — September 1971.

Work commenced in October, 1969.

Contract 4 — Additions to the low lift and high lift pumping stations. Estimated contract cost — \$300,000.00.

Orders for the pumps were placed in December 1969.

Tenders are expected to be called in April 1970 with construction to commence in May.

-03: 36-inch diameter Queensway feedermain.

Consulting Engineers: Gore & Storrie Ltd., Toronto.

Estimated Contract Cost: \$300,000.00.

This project was advertised in December 1969 with an expected contract award in February 1970.

-04: 60-inch diameter Silverthorne feedermain.

Consulting Engineers: Gore & Storrie Ltd., Toronto.

Estimated Contract Cost: \$1,500,000.00.

This project was nearing completion in design late in 1969 with an expected tender call early in 1970.

-05: 60, 54 and 48-inch diameter watermain — Burnhamthorpe-Tomken Rds.

Consulting Engineers: Gore & Storrie Ltd., Toronto.

Completed: November 4, 1969.

Final Project Cost: \$194,608.00.

This project was carried out in conjunction with intersection improvements and road-widening at the above location and the watermain constructed will form a part of the future Hanlan feedermain.

The following projects were under design in 1969 with tender calls scheduled for 1970:

-06: Becket-Sproule reservoir and pumping station.

Consulting Engineers: W. O. Chisholm & Associates Ltd., Scarborough.

Estimated Contract Cost: \$1,690,000.00.

-07: Hanlan feedermain — Silverthorne to Burnhamthorpe.

Consulting Engineers: McCormick & Rankin Ltd., Port Credit.

Estimated Project Cost: \$212,000.00.

-08: Hanlan feedermain — Burnhamthorpe to Hanlan.

Consulting Engineers: Canadian-British Engineering Consultants Ltd., Don Mills.

Estimated Contract Cost: \$1,165,000.00.

-09: Silverthorne pumping station revisions.

Consulting Engineers: Gore & Storrie Ltd., Toronto.

Estimated Contract Cost: \$300,000.00.

-10: Hanlan pumping station revisions.

Consulting Engineers: Proctor & Redfern Ltd., Toronto.

Estimated Contract Cost: \$1,000,000.00.

-11: Streetsville feedermain.

Consulting Engineers: G. V. Kleinfeldt & Associates Ltd., Brampton. Completed: December 19, 1969.

Final Project Cost: \$97,500.00.



SOUTH PEEL AREA SEWAGE PROJECTS (1-0053-66) (The numbers below indicate the sub-projects)

-01: Extensions to the Lakeview water pollution control plant.

Consulting Engineers: Gore & Storrie Ltd., Toronto.

Contract 1 — Digestion, heating and grit removal facilities. Estimated contract cost — \$3,800,000.00.

Contract 2 — Settling works. Estimated contract cost — \$6,000,000.00.

Contract 3 — Outfall sewer.

Contracts 1 and 2 were advertised in 1969 with a closing date for tenders of January 21, 1970.

-02 North part of east trunk sewer.

Consulting Engineers: Proctor & Redfern Ltd., Toronto.

Estimated Contract Cost: \$5,000,000.00.

It is expected that there will be five contracts under this project. One contract, Contract No. 8, comprising approximately 2,500 feet of 66-inch concrete sewer was started in December 1969 and is scheduled for completion in May 1970. This section is being constructed in conjunction with Department of Transport runway extensions at a cost of \$200,375.00.

-03: West trunk sewer.

Consulting Engineers: Canadian-British Engineering Consultants Ltd., Don Mills.

Estimated Contract Cost: \$10,000,000.00.

This project was assigned for design in 1969 with a probable start on construction in mid-1970.

-04: Clarkson water pollution control plant.

Consulting Engineers: Gore & Storrie Ltd., Toronto.

This project was assigned for a study on staged development and land use at existing facilities. Design is expected to commence in 1970 with a construction start in 1971.

STAYNER (6-0179-68)

Description: Well pumphouse and appurtenances.

Consulting Engineers: Gore & Storrie Ltd., Toronto.

Completed: June 3, 1969.

Final Project Cost: \$56,000.00.

TRENT RIVER POLLUTION CONTROL SYSTEM NO. 1 (1-0028-66)

Description of Project: Sewage works for the Town of Campbellford.

Consulting Engineers: Canadian-British Engineering Consultants Ltd., Toronto.

Contract A — Sanitary trunk sewer and forcemains. Estimated contract cost — \$129,826.00. Expected completion date — February 1970.

Work started in August 1969 and was about 80% completed by the end of the year.

Contract B — Water pollution control plant and two sewage pumping stations. Estimated contract cost — \$853,558.00. Expected completion date — September 1970.

Work started in August 1969 and was about 20% completed by the end of the year. Most of the concrete had been poured for the primary clarifiers, digester, digester control building and main control building.

Estimated Project Cost: \$1,134,100.00.

TRENTON (2-0225-67)

Description of Project: Extensions to sewers, a sewage pumping station and forcemain.

Consulting Engineers: Gore & Storrie Ltd., Toronto.

Completed: May 1, 1969.

Final Project Cost: \$368,570.00.

WALLACEBURG (2-0181-65, 2-0226-67 and 1-0087-67)

Description of Project: A sewage treatment plant, sewage pumping stations, forcemains and sanitary sewers.

Consulting Engineers: Todgham and Case Ltd., Chatham; Gore & Storrie Ltd., Toronto.

Contract 1 — Trunk sanitary sewer (Gillard St.). Final contract cost — \$128,750.00. Completed — June 28, 1966.

Contract 2 — Trunk sanitary sewer (Gillard and Wallace Streets). Final contract cost — \$532,514.00. Completed — June 20, 1967.

Contract 2A — Interceptor sewer (Wallace St.). Final contract cost — \$43,858.00. Completed — April 22, 1968.

Contract 3 — Sanitary sewers and forcemain. Final contract cost — \$549,894.00. Completed — September 30, 1969.

Contract 4 — Napier-Dundas pumping station. Estimated contract cost — \$77,661.00. Expected completion date — February 1970.

The station will be taken over by the OWRC early in 1970 after the standby power facilities have been installed and the station test run.

Contracts 5A, 5B and 5C — Sanitary sewers and forcemain. Estimated contract cost — \$1,577,500.00.

Tenders not yet called (see schedule comment below)

Contracts 6, 7, 8, 9, 10 and 12 — Sanitary sewers, river crossings and pumping stations. Estimated contract cost — \$1,963,620.00.

Tenders not yet called (see schedule comment below)

Contract 11 — Sewage treatment plant. Estimated contract cost — \$1,316,000.00. Expected completion date — July 1970.

The major part of the substructure work has been completed. Superstructures, equipment installation and internal pipework have yet to be started.

Estimated Project Cost: \$7,889,660.00.

Schedule: The timing and extent of all further work depends upon the reappraisal of the financial aspects of the project which are presently undergoing review by the Ontario Municipal Board.

TOWNSHIP OF WHITCHURCH (6-0118-63)

Description of Project: Relocation of watermain.

Consulting Engineers: Crysler, Davis & Jorgensen Ltd., Willowdale.

Completed: October 5, 1969.

Final Project Cost: \$12,688.00.

This work was done for Department of Highways road-widening purposes and the Department shared in the project costs in the ratio of 55:60 of the total cost.

WOODSLEE (6-0184-68)

Description of Project: Extension of existing watermain and the provision of new hydrants and private service connections in the townships of Gosfield North, Maidstone and Rochester.

Consulting Engineers: C. G. Russell Armstrong Associates Ltd., Windsor.

Completed: August 22, 1969.

Final Project Cost: \$99,497.00.



Division of Finance

E. F. Heath, Director and Comptroller

In 1969, the Division of Finance executed financial control over the diversified funds which come within the Commission's jurisdiction. This control was achieved by the active participation and co-ordination of the General Accounting, Budget, Insurance and Audit branches.

The supporting information and data, set out below, indicate the activities for 1969.

GENERAL ACCOUNTING BRANCH

The General Accounting Branch is responsible for the preparation of the Commission's Head Office and Plant Operators payrolls, the processing and payment of all general expenditures, capital disbursements and operating expenditures, as well as the collection of all billings issued to municipalities in accordance with the existing project agreements.

During 1969 the Branch processed general expenditures of \$9,873,529 and gross capital disbursements of \$28,369,511 — this being a substantial increase over the 1968 expenditures processed of \$8,833,383 and \$17,470,104 respectively.

In the 1969 calendar year, capital receipts of \$6,121,895 were received, compared with \$4,596,519 in 1968. The majority of these monies were loan advances from C.M.H.C. which are applied against the cost of the projects.

The total billings to municipalities in 1969 for all Municipal and Provincial projects increased to \$15,261,973 from \$12,710,392 in 1968. For Municipal projects, the billings reflect the amounts due to the Commission for debt retirement, reserve for contingencies, interest charges and operating expenditures. For Provincial projects, the billings represent amounts due for water consumption and sewage treatment.

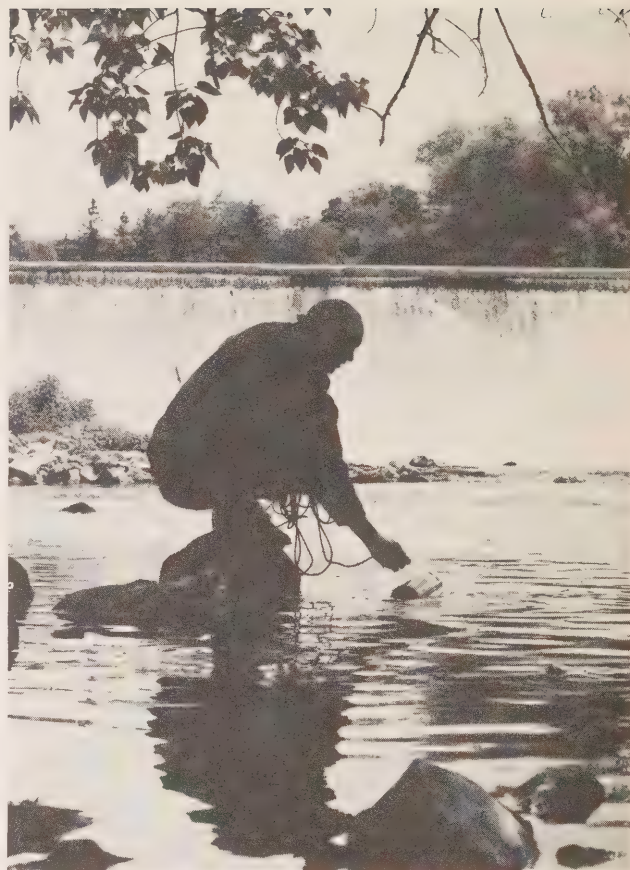
Funds received from Municipal projects for Debt Retirement (\$1,969,838) and Reserve for Contingencies (\$634,225) were invested by the OWRC Investment Committee in accordance with the OWRC Act. At December 31, 1969, the balance in the Debt Retirement Fund amounted to \$16,291,207, while the balance in the Reserve Fund was \$5,142,705.

Interest payments received with respect to completed projects amounted to \$7,555,420 and were applied as a reduction of the interest due to the Province on the Commission's borrowings.

In 1969, \$5,129,501 was expended from the billings to municipalities on the operations of projects compared to \$4,231,407 in 1968.

At December 31, 1969, loans from the Province of Ontario for the purpose of constructing water and sewer projects totalled \$145,404,739 (Municipal \$8,121,513, Provincial \$61,283,226).

The effective rate of interest payable to the Province on the total loans was 6.26% or some \$9,098,925 per annum.



BUDGET BRANCH

During the year, the Budget Branch assembled and co-ordinated all pertinent data required in the preparation of the Commission's annual budgets, maintained financial control of the funds for its programs and activities, and provided assistance to many of the divisions in the preparation of their annual estimates.

In the 1969/70 fiscal year, the general expenditures for the Commission's programs are estimated at \$9,625,000. These expenditures were reported to various levels of management on a monthly basis in comparative form of budget/actual. On many occasions, additional statistical and cost information was supplied upon request.

In order to maintain the essentials of a good budget and cost system, the classification of expenditures was further developed to reflect the nature of the various spendings within the Commission. Each year's classified expenditures provide additional cost records and historical data on the expenditures of the many activities and are most useful to Management in assessing future estimates as well as providing essential information for current patterns and long-term forecast trends.

INSURANCE BRANCH

During the year, the completion of various construction contracts and the acquisition of various sewage and water facilities in the Southern Peel County Area increased the Commission's insurance coverage on plants and equipment to \$100,360,700 (Municipal \$58,787,900 and Provincial \$41,572,800).

The number of claims processed during the year was 16, which was lower than usual, although the amount claimed — \$23,360 — was higher than usual.

The Branch continued to act in a consulting and advisory capacity to the Petroleum Resources Section of the Department of Energy and Resources Management.

AUDIT BRANCH

During 1969 the Internal Audit Branch continued to perform a pre-audit of all operating expenditures, year end precepts, quarterly billings and supporting schedules. Capital and ordinary vote expenditures were reviewed on a sample basis. Several post-audits were completed with respect to travel claims, print shop operations and the inventory control functions relating to Commission projects.

The Branch was instrumental in the issuance of an employee guide for Travel and Living Expenses, and recommendations were made for the design and implementation of log books for Commission-owned vehicles.

A continuous review of Commission assets was made throughout the year to ensure that they were safeguarded from losses of all types and to determine the adequacy and application of accounting controls and the extent of compliance throughout the Commission with respect to existing controls, policies and procedures.

Considerable time was spent providing financial assistance with respect to the acquisition of Provincial projects. In addition, a monthly analysis was made of the operating statements prepared by the Systems and E.D.P. Branch with a view to determining the cause of variances between this data and the records maintained by the Division of Finance. Recommendations were made to correct the inconsistencies noted, where it was considered necessary.

During 1969, continued emphasis was placed on the auditing of payrolls for both Plant Operations and Head Office casual staff, as well as the field audits of various Commission projects. Audit reports were issued to those concerned and corrective action obtained where necessary.

ONTARIO WATER RESOURCES COMMISSION (Constituted by Special Act of the Ontario Legislature)

BALANCE SHEET

as at December 31, 1969

ASSETS

Capital Account	
Cash in bank	\$ 1,183,917.62
Recoverable advances	95,171.18
Accounts receivable	4,121,020.34
Capital assets	
Completed projects owned by Ontario Water Resources Commission	131,256,769.68
Capital advances for completed municipal projects	29,336,025.99
Construction in progress	9,664,998.59
Deficit on operations of provincial projects *	1,190,649.35
Amounts due from reserve account	13,161.75
Amounts due from debt retirement account	18,457.54
	<u>\$176,880,172.04</u>
Reserve Account	
Cash in bank	\$ 25,169.71
Accrued interest receivable	87,497.91
Investments (Market value \$3,917,461.25)	5,043,198.69
	<u>5,155,866.31</u>
Debt Retirement Account	
Cash in bank	\$ 35,081.04
Accrued interest receivable	277,865.91
Investments (Market value \$12,553,695.00)	15,996,717.64
	<u>\$ 16,309,664.59</u>
	<u>\$198,345,702.94</u>

* In order to stabilize the service rate on a Provincial project, the rate is established on the basis that the cumulative revenue will equal the cumulative charges of principal, interest and operating expenses by the end of the 20th year of operation. As a result, it is anticipated that during the early years of a project's operations, deficits will be incurred which will not be fully recovered until the end of the 20th year.

LIABILITIES

Capital Account	
Accounts payable and contract retentions	\$ 18,505,081.76
Advances from municipalities and others	
Operating and interest	\$ 1,474,513.61
Capital	10,904,476.64
Due to Province of Ontario	
Treasury Department advance	100,000.00
Funded debt payable to Province of Ontario	145,404,739.41
Equity in provincial projects	491,360.62
	<u>\$176,880,172.04</u>
Reserve Account	
Funds for renewals, replacements and contingencies under Section 43 of the Act	\$ 5,142,704.56
Amounts due to capital account	13,161.75
	<u>\$ 5,155,866.31</u>
Debt Retirement Account	
Sinking fund for the recovery of the cost of capital assets at 3¼% under Section 44 of the Act	\$ 16,291,207.05
Amounts due to capital account	18,457.54
	<u>\$ 16,309,664.59</u>
	<u>\$198,345,702.94</u>

Note: As at December 31, 1969 commitments had been made under final agreements executed for the construction and acquisition of projects requiring additional gross expenditures of approximately \$137,000,000.00 of which \$37,000,000.00 is estimated to be expended during 1970.

Division of Industrial Wastes

D. P. Caplice, Director

H. A. Clarke, Assistant Director

The Division of Industrial Wastes is responsible for the administration of the OWRC industrial pollution control program and performs a regulatory function under Sections 27, 31 and 50 of the OWRC Act. The activities of the Division are coordinated by the Administration Branch and fall into three general areas: Field Services, Design Approvals and Special Projects.

The Field Services Branch regularly assesses all sources of industrial pollution and prepares reports setting out the volume, character and pollutorial content of the discharges. These reports provide the basis for maintaining an inventory of industrial waste loadings to watercourses, determining the status of control and the action required to obtain compliance with the Commission's objectives. Another function of the Branch is to advise industries and municipalities regarding pollution control relating to the location of new plants and the expansion of existing plants. Problems associated with the discharge of industrial wastes to municipal sewage systems are investigated by field personnel. To ensure that adequate control is maintained on discharges to watercourses, the Branch has a regular surveillance program.

The Design Approvals and Special Projects Branch carries out the following functions: (a) the review of engineering plans from industry where the effluent from the proposed treatment works will be discharged to a watercourse or storm sewer, and the issuing of certificates of approval under the terms of Section 31 of the OWRC Act; (b) the arranging of public hearings concerning applications where the proposed works are to extend from one municipality to another; (c) the providing of specialized technical appraisal of difficult waste control problems on an individual-company or industry-wide basis; (d) the reviewing of design reports for provincially-financed municipal sewerage schemes with respect to industrial waste loadings; and (e) the providing of advice and assistance to municipalities in the preparation of sewer-use by-laws to regulate industrial discharge to municipal sewers.

FIELD SERVICES BRANCH

Important commitments for waste treatment facilities costing several millions of dollars were obtained in 1969 from a number of industries including pulp and paper mills, the steel industry, the mining industry and the automotive industry. In general, industry exhibited an increasing willingness to reduce its contribution to the pollution of the Province's waterways and this positive approach resulted in an increased number of waste treatment proposals being submitted as compared with previous years. This change in attitude was certainly due, in part, to vigorous expressions of public concern appearing in the news media

against pollution of the environment.

Evaluation of treatment efficiencies of OWRC-approved facilities continued to expand as an important field activity as more industrial treatment works became operational. In addition, every industrial plant which received a certificate of approval for treatment works was requested to conduct its own effluent quality monitoring program and to submit data to the Commission at regular intervals. This procedure was implemented principally to keep industry constantly aware of its responsibility for insuring satisfactory effluent quality control as part of its overall manufacturing operations.

The concern of the Commission with respect to the water pollution problems caused by industrial accidents was brought to the attention of all industries which discharge effluents to natural watercourses. These plants were instructed to seek out situations having a potential for spills and to take steps to prevent such spills taking place. Also, industry was requested to notify OWRC personnel immediately of major spillages to watercourses of hazardous substances so that downstream users could be warned and remedial measures implemented quickly.

Staff made approximately 2,300 field contacts and carried out 100 full scale industrial waste surveys during the year. As a result of this work, 89 formal reports were issued and the respective companies were instructed to take the necessary action to control their effluent discharges. In bringing waste treatment and disposal programs to the design approvals stage, field personnel participated in 378 meetings with industrial officials and their consultants. Several major studies were undertaken which are outlined below in the summary of activities concerning the major industrial classifications.

The Division continued to work with new industries to ensure that appropriate waste treatment facilities were planned concurrently with general plant design, and the facilities installed in time for the start of production. Twenty-seven applications for waste treatment and disposal facilities were approved in 1969 for new industries or expansions to existing industries at an estimated cost of \$2,100,000.

BASIC IRON AND STEEL

The most significant development in 1969 in the basic iron and steel industry was the public commitment, towards the end of the year, by the three major steel producers to multi-million dollar programs leading to control of industrial effluents to meet existing OWRC quality objectives. The programs announced were quite comprehensive and dealt with the outstanding major problems remaining in the industry, such as the control of oil, together with other less

significant sources of pollution.

The Algoma Steel Corporation, Limited, made further improvements to remove oil from its effluents discharging to the St. Mary's River. An additional oil separator was installed and a terminal basin with an extended outfall was constructed at the end of the main plant sewer. This latter facility, primarily for the control of accidental oil losses, is also expected to remove suspended solids which should result in aesthetic improvements to the river. The facility was in operation by the end of the year. The long range program developed by the Company will achieve better control of the existing pollution problems by the end of 1971, and treatment projects beyond 1971 are tied in with planned increases in production.

Dominion Foundries and Steel, Limited, began two major projects during the year. Acid pickle lines were being converted for use with hydrochloric acid and construction began on an acid regeneration plant to recover and recycle the acid. The second project involved the use of high-rate filters to remove mill scale from the wastes which originate in hot rolling of steel. The major portion of the Company's program is scheduled for completion by the end of 1971 with the remaining items to be completed in 1972.

The Steel Company of Canada, Limited, in its overall control program, has given priority to increased capacity in the acid regeneration system, improved control of chemical wastes from the coke ovens and better removal of soluble oils from the cold rolling processes. Again significant improvements are scheduled for completion by 1972.

Although the Lake Erie development of the Steel Company of Canada, Limited, has been postponed temporarily, the proposed treatment system has some interesting features. Recirculation of treated effluents appears to be an integral part of some of the processes, and operational failures of the waste treatment facilities could result in temporary cessation of production.

In other areas, Atlas Steels Company in Welland was involved during the year in sewer segregation work, and further improvements were made by Lake Ontario Steel Company Limited in Whitby.

CHEMICAL AND PETROLEUM

The chemical and petroleum industries made significant advances in 1969 in controlling pollution of watercourses by wastes from existing plants. Several new plants also applied for approval of waste treatment works. A total of 27 applications were approved and these involved an estimated expenditure of about \$2,300,000 for capital works and engineering charges. Seven other applications remained under review at the year's end.

Several projects were undertaken to reduce the discharge of contaminants at the following plants: Allied Chemical Canada, Limited, Amherstburg; Du Pont of Canada Limited, Township of Augusta (Maitland); Marbon Chemical Division of Borg-Warner (Canada) Limited, Township of Hamilton; Electric Reduction Company of Canada, Lim-

ited, Port Maitland; and Canadian Industries Limited, Copper Cliff.

In the petroleum refining and petrochemical industry, Imperial Oil Enterprises, Limited, Sarnia, and Gulf Oil Canada Limited, Mississauga, revealed long range waste control programs which should result in improved water quality conditions in the vicinity of these two refineries. Shell Canada Limited, Township of Moore, received Commission approval for two pollution projects, on completion of which, the effluent should essentially comply with OWRC effluent quality objectives. A status report on pollution control at oil refineries in Ontario was completed towards the end of the year. The degree of effluent control achieved by the oil industry in Ontario was found to be generally satisfactory and superior to that of refineries of comparable size in the United States.

Several applications were received from Dow Chemical of Canada, Limited, and Polymer Corporation Limited of Sarnia, and an extensive survey of Dow's Sarnia operations was carried out. The results of this survey will indicate where corrective action is needed. Approval of plans for waste treatment was granted to Allied Chemical Canada, Limited, Township of Falconbridge, where a plant is being constructed to produce elemental sulphur from stack gases produced by a nearby ore processing plant.

FOOD PROCESSING

Continued progress was made during 1969 towards the provision of proper waste treatment facilities in the food processing industries. Twenty-one applications were received for Commission approval of waste control facilities costing approximately \$1,960,000. Companies making significant expenditures during the year included Libby, McNeill & Libby of Canada, Limited; Corby Distilleries Limited; Hiram Walker & Sons Limited; Kraft Foods Limited; Campbell Soup Company Limited and J. M. Schneider Limited.

In the cheese manufacturing industry, the disposal of whey continues to pose a difficult problem in many parts of the Province. In some locations, whey is used as animal feed but, for the most part, it is deposited on land and often drains into natural watercourses. The economics of a whey drying plant in Eastern Ontario to produce food grade whey powder were investigated in the hope that the building of such a plant could be encouraged as a method of solving the whey disposal problem.

Considerable progress was made by the canning industries in providing adequate waste treatment facilities. Of the problems remaining, it is expected that most of the major ones will be corrected within the coming year.

MINING

The Division's program with the mining industry continued at a very active level during 1969. Special attention was directed to The International Nickel Company of Canada, Limited, development at Lake Shebandowan and the Griffith Mine of The Steel Company of Canada, Limited. A public hearing was held concerning the latter Company's plans for a perimeter dyke in Bruce Lake. Exploration and

development in Northwestern Ontario was active with a number of base metal mines under consideration.

The detailed research work initiated in 1968 in the Elliot Lake area was concluded in 1969 and specific recommendations on corrective action will be made to the companies concerned. In the Sudbury area, an intensive field review of The International Nickel Company of Canada, Limited, properties was conducted. Specific action was requested and several programs were initiated which are now in various stages of progress.

In Northeastern Ontario, efforts continued to be directed towards rehabilitation of tailings disposal sites in the Timmins and Cobalt areas, with emphasis on defunct properties. Routine surveillance of industrial operations comprised the major portion of the field program and several aerial inspections were made.

During the year, 21 applications for approval of mining waste control facilities were received and processed, the total value of which amounted to \$958,400. Sixteen of these were for the control of suspended solids, four for neutralization facilities and one for the re-use of treated wastewater.

PULP AND PAPER

Continuing progress was made during 1969 on suspended solids reductions by this industry, mainly through in-plant control techniques and bark fines recovery systems. Nine applications for treatment works from the pulp and paper industry were approved at an estimated cost of approximately \$5,700,000, which is to be spent over the period 1969-72.

The clarifier at the Thorold mill of Abitibi Provincial Paper Limited, became fully operational during 1969 with the installation and continuous operation of a centrifuge for sludge dewatering. Approximately twenty-five tons of suspended solids materials were being removed daily from the mill effluent which discharges to the Old Welland Canal. The Ontario Paper Company Limited, Thorold, constructed a clarifier during 1969 which will become operational in early 1970, when sludge dewatering equipment is installed. Lagoon systems to reduce suspended solids discharges were constructed at the Fort William and Thunder Bay mills of the Abitibi Paper Company Limited. These systems will be completed in 1970. The Great Lakes Paper Company, Limited continued with the implementation of its eight-year waste treatment program. During 1969, a trunk collector sewer and pumping station to transfer wastes from the "Old Mill" to the treatment site were completed.

Waste treatment proposals for the removal of suspended solids by mechanical clarification were submitted by nine mills. Installation of these clarifiers is planned throughout the period 1970-72. One mill submitted plans for a lagoon system to reduce suspended solids loadings by 1971. Most of these mills will approach the OWRC requirement for suspended solids when the proposed programs are completed. Also, technical staff worked closely with Kimberly-Clark of Canada, Limited, to develop a satisfactory waste treatment system for a new mill at Huntsville and with The

regarding a proposed kraft mill at Fort Frances. Both systems should afford adequate protection of the receiving watercourses.

Negotiations were conducted with a number of mills regarding additional treatment of wastes over and above suspended solids control, but the industry appears reluctant to recognize this need. However, the OWRC intends to press for secondary treatment of kraft mill effluents because of the unique problems associated with watercourses receiving these wastes through the Province. In addition, treatment or elimination of spent pulping liquors from sulphite mills is being considered as a requirement at certain locations.

The OWRC resorted to the use of legal action against the pulp and paper industry during 1969. Charges under Section 27 of the OWRC Act were laid against Domtar Newsprint Limited for its operations at the Red Rock mill. Also, a ministerial order in accordance with Section 50 of the OWRC Act was issued to The Ontario-Minnesota Pulp and Paper Company, Limited, for the construction and operation of waste treatment works by stipulated dates at its Kenora mill.

In October 1969, a member of staff presented a paper at the Fifth Air and Stream Improvement Conference sponsored by the Canadian Pulp and Paper Association. This paper entitled "The OWRC Regulatory Control Program for the Pulp and Paper Industry" detailed OWRC requirements for waste treatment for the pulp and paper industry in Ontario.

SECONDARY INDUSTRIES

This category includes tanneries, textile mills, automotive industries, metal plating and fabricating plants, rendering plants, manufacturers of building products and the service industries. Thirty certificates for waste treatment facilities were issued in 1969 at an estimated cost of about \$3,400,000.

Tanneries and textile mills generate liquid wastes containing high concentrations of suspended solids and oxygen-consuming organic materials. Wastes of this nature, after suitable pretreatment at the point of origin, are generally amenable to conventional treatment at the municipal sewage plant and this, in most cases, is the treatment approach followed throughout the Province.

During 1969, Barrie Tanning Limited, Barrie, The Breithaupt Leather Company Limited, Campbellford, and Dominion Woollens and Worsteds, Hespeler, completed the installation of necessary treatment works at a cost of \$300,000.

The metal plating and fabricating industry generates liquid wastes containing cyanides, oils, acids, alkalies, and heavy metals. The uncontrolled discharge of these materials to a watercourse can result in extensive fish kills and, more insidiously, can cause a general deterioration of the aquatic environment and disrupt the delicately balanced inter-relationships of an aquatic community. Recovery of the community to healthy and productive conditions is a slow and gradual process and can only take place after the offending discharges have been eliminated.

During the year, major waste treatment projects were completed or underway at Comco Metal Products Limited, Uxbridge; P. L. Robertson Manufacturing Company Limited, Milton; East Side Plating Company Limited, Windsor; Ford Motor Company of Canada, Limited, Windsor; and Seeburn Metal Products Limited, Beaverton. In addition, many relatively minor problem situations were corrected during the year by the installation of small treatment units at various locations.

Rendering plants produce liquid wastes essentially organic in nature, containing a high concentration of animal greases and, if improperly handled, are characterized by an offensive odour. At Rothsay Concentrates Limited, Township of Maryborough, a six-stage waste treatment and disposal system consisting of grease separation, biological oxidation and spray irrigation was completed during the year. The pretreated waste is sprayed on land, thereby eliminating a waste discharge to the Conestogo River.

The building products industry generates a waste containing inorganic suspended solids which can be removed by settling. A pilot installation is being installed at the Vaughan Yard of Canada Building Materials Limited to remove the solids and alkalinity from plant area runoff. If successful, similar facilities will be considered at other locations in the Province.

During 1969, continued emphasis was placed on the control of oil-bearing liquid wastes discharged from maintenance shops and refuelling stations of the rail transportation industry. As a result, the CNR at Armstrong and at Sioux Lookout and the CPR at Chapeau either have already installed the necessary oil control facilities or have begun construction of the necessary treatment works.

LEGAL ENFORCEMENT MEASURES

In general, industries in the Province have shown a willingness to cooperate with the OWRC and have proceeded with effective programs for waste treatment and disposal. However, in a number of instances in 1969, acceptable control programs were not received even after lengthy discussions with the industries and extensive field work by staff to document the problems. In addition, there were a number of major spills of hazardous materials to watercourses largely due to negligence on the part of industry. It was, therefore, decided to resort to punitive action and six industries were charged under Section 27 of the OWRC Act for potential impairment of receiving watercourses. Of these, two were convicted while the remaining four were either awaiting trial or a court decision in early 1970.

During 1969, greater emphasis was placed on the use of Section 50 of the OWRC Act which permits the OWRC, by order of the Minister, to require industry to comply with stipulated requests by fixed dates. The order is used to make it mandatory for a plant to first undertake a study of its pollution problem and then embark on a scheduled program to install the necessary works for resolution of the pollution problem. Three such Orders were issued this year. In two of these cases, the installation of the necessary treatment facilities are scheduled to be completed by 1970.

An Order issued to Uniroyal (1966) Limited, Elmira, in March 1969, illustrates the use of Section 50 of the Act. The Company was directed to make investigations, submit reports and take specific action to eliminate seepage and runoff to Canagagigue Creek from waste ponds, burial areas and equalization ponds, to improve the pretreatment of process wastes discharged to the municipal sewage treatment plant in order to alleviate the poor performance of the plant, and to carry out a general review of disposal practices of all classes of wastes.

In general, legal recourse appeared to produce the desired effect in that corrective actions were taken immediately by the industries involved. These and other applicable sections of the Act will continue to be used where deemed justifiable and necessary.

DESIGN APPROVALS AND SPECIAL PROJECTS BRANCH

(a) Design Approvals

Control of industrial waste disposal is regulated through the implementation of Section 31 of the OWRC Act which requires industry to submit applications to the Commission for approval of plans for the collection, transmission, treatment and disposal of industrial wastes. Applications are reviewed and, if found satisfactory, certificates of approval are issued. Prior to approval, however, consideration is given to the holding of public hearings under Section 32 of the Act. Hearings are mandatory if the installations involve the transmission of wastewaters across municipal boundaries for disposal or treatment.

Table 1 summarizes the applications processed in 1969 and Table 2 presents a breakdown, by industrial classification, of the 116 certificates issued by the Commission involving estimated total costs of \$15,080,600. In addition, nine submissions were given concurrences involving a total estimated cost of \$160,000. These control facilities were not subject to Section 31 of the Act as they were classed as in-plant control measures, non-effluent systems involving wastewater re-use, or pretreatment systems with discharges to municipal sewage treatment plants. Twenty-three applications involving industrial expenditures of \$3,257,000 were under review at the end of the year.

The most comprehensive proposal for industrial waste treatment facilities, at an estimated cost of \$1,700,000, was submitted by Kimberly-Clark of Canada, Limited, to serve its new tissue paper mill in the Township of Chaffey near Huntsville. The system exemplifies the principle of conservation of water, as the water and waste treatment facilities were integrated to permit recirculation of ninety per cent of the mill wastewaters. The waste treatment system consisting of a clarifier, vacuum sludge filter, settling basin, percolation basin and submerged diffuser outfall, is scheduled to be completed and in operation by October 1970 and should produce an effluent to the East River in keeping with OWRC objectives. The Company's application was approved by the Commission subsequent to a public hearing which gave interested parties in the area an opportunity to question the Company fully on its treatment proposal.

The application submitted by Corby Distilleries Limited, Belleville, is an interesting example of the involvement and cooperation of a government agency, engineering consultant and company, working together to arrive at an acceptable waste treatment program. Prior to the submission of the application, a considerable amount of research was carried out by the Company through extensive bench scale and pilot plant studies to gain the knowledge necessary to develop and operate a satisfactory treatment system. Throughout the research program, the Company maintained continuous liaison with the OWRC. The consulting engineers prepared the application and plans on the waste treatment plant which included separate cooling towers for clean and contaminated wastes, an activated sludge unit and associated clarifier, and a polishing oxidation lagoon. The entire system was approved by the OWRC and an evaluation survey, performed after start-up in the summer of 1969, indicated that the treatment facilities were operating efficiently. The estimated cost of the works to the Company was \$441,000.

TABLE 1

SUMMARY OF PROJECTS FOR 1969

	ITEMS	ESTIMATED CAPITAL COST
Applications Outstanding as of December 31, 1968	18	
Applications Received in 1969	138	
Total	156	
Certificates of Approval Issued	116	\$15,080,600
Applications Reviewed — Concurrence given	9	\$ 160,000
Sub-Total	125	\$15,240,600
Applications Reviewed — Approval not given	8	
Applications Under Review or in Abeyance as of December 31, 1969	23	\$ 3,257,400
Total	156	\$18,498,000
Project Meetings	220	
Public Hearings (OWRC Act, Section 32)	6	

TABLE 2

1969 CERTIFICATES ISSUED — INDUSTRY CLASSIFICATION

	NUMBER OF CERTIFICATES	CAPITAL COST
Chemical and Petroleum	27	\$ 2,275,900
Food	21	1,959,600
Manufacturing	30	3,396,600
Mining	21	958,400
Pulp and Paper	9	5,686,300
Services	6	272,800
Steel	2	531,000
	116	\$15,080,600

(b) SPECIAL PROJECTS

Contingency Planning

Incidents such as the Torrey Canyon disaster and the Santa Barbara oil well spill have impressed upon pollution control authorities the need to develop an organized plan to cope with major spills of oil. The Commission, cognizant of the need to have a contingency plan, particularly in the Great Lakes Drainage Basin, has a surveillance and notification system for spills of hazardous materials and staff have initiated the development of a contingency plan which will outline the response mechanisms to the control, containment and clean-up of a large spill. The plan will also contain an inventory of the available resources of manpower, equipment and chemicals which can be mobilized for spills in a particular area. The chemical industries in the Sarnia area on the St. Clair River and the oil refineries on Lake Ontario near Toronto have already set up their own localized contingency plans.

Industrial Pollution Control in Municipalities

Municipalities are becoming increasingly aware of the need to control indiscriminate discharges of industrial wastes to municipal sewerage systems through the enforcement of appropriate municipal sewer-use by-laws. With a view to providing guidance and assistance in this important phase of the industrial waste control program, staff forwarded sewer-use by-law information to 40 municipalities, reviewed and commented upon 9 proposed by-laws and attended 8 meetings with municipal officials to discuss proposed sewer-use by-laws.

To assist municipalities further, staff developed and arranged an industrial waste by-law enforcement course for municipal officials. The course was well received and 49 municipal officials representing 35 municipalities attended. It is planned to hold this course on an annual basis as long as the need exists.

Ontario Industrial Waste Conference

This annual conference has developed into an important forum for presenting case histories of industrial pollution problems that have been solved successfully in Ontario and other parts of the world, and for exploring new concepts in waste treatment technology. The 16th Conference was attended in 1969 by over 300 persons who were drawn from industry and other sectors having a strong interest in industrial pollution control. As in past years, staff of the Division were prominent in the selection of speakers and associated papers for the technical program.

Oil and Gas Well Drilling in Lake Erie

Since 1913, a total of 597 wells have been drilled in Lake Erie, the majority of them in Canadian waters. Approximately 75 wells were drilled in 1969. Investigations by the Commission to determine whether these operations contributed significantly to the pollution of Lake Erie indicated that, at the present time, the industry is taking adequate precautions to control pollution which may result from discharge of oil, fracturing fluids, brines and drilling muds.



Provincial Sewage Works

The evaluation of potential industrial waste loadings in the design reports prepared for Provincially-financed sewage works programs is a continuing function of the Special Projects group. As part of this function, 48 design reports were reviewed and 17 meetings were attended in 1969.

Rehabilitation of Mine Tailings Areas

The inter-departmental government committee on Mine Tailings Disposal, established to review mine tailings disposal practices, completed its report and submitted it to the Deputy Ministers' Advisory Committee on Pollution Control for further consideration. The report concluded that current practices were not satisfactory in view of the potential environmental hazards posed and recommended that legislation be enacted whereby mining companies would be required to rehabilitate or otherwise stabilize abandoned tailings disposal areas.

Sudbury Area Fog Study Report

Periodically, isolated occurrences of fog have occurred in the area of Copper Cliff Creek contributing to hazardous driving conditions on Highway No. 17, west of Sudbury. Despite several improvements to the construction and lighting of the highway by the Department of Highways, the dense fogs posed a real threat to the safety of motorists. A group consisting of representatives from provincial and municipal agencies, The International Nickel Company of Canada, Limited, and the local pollution committee was formed to study the matter. Because of the possibility that thermal effects of wastes discharged to the Copper Cliff Creek might have been partly responsible for the fog occurrences, The International Nickel Company of Canada, Limited, diverted warm water effluents from its process operations away from the Creek, together with the discharge from the municipal sewage treatment plant. Although the natural topography of the area is conducive to

the formation of fogs under certain conditions, a study group was of the opinion that the elimination of the heated discharges should improve the situation. Other means of reducing or dispersing the fogs were not considered to be practicable.

Thermal Generating Stations

The environmental studies in Lake Erie off Nanticoke involving Ontario Hydro, The Steel Company of Canada, Limited, the Department of Lands and Forests and the OWRC continued. Most of the data necessary to describe the existing condition of the aquatic environment, prior to start-up of the thermal station, have been collected. Among other studies, Ontario Hydro is evaluating the dispersion characteristics of the thermal plume into Lake Ontario from the Lakeview Generating Station. Discussions continued with Ontario Hydro and Atomic Energy of Canada Limited regarding waste disposal procedures for the nuclear power plants at Pickering and Bruce and for the heavy water plant at Douglas Point.

Uranium Mining, Milling and Refining Industry

Intensive surveys were carried out at the operating uranium mines as part of the overall radiological studies being conducted by the Commission in the Elliot Lake area. Good control of radioactive contaminants is being achieved at the operating mines and these have also outlined programs for long-term containment of mill tailings. Close liaison was maintained with a new uranium mine under development in the Agnew Lake area to ensure that effective tailings containment and effluent control measures are undertaken.

Eldorado Nuclear Limited in Port Hope began the construction of a uranium hexafluoride plant during the year. The OWRC was represented on the Ad Hoc Safety Committee for this plant to ensure that satisfactory effluent disposal was planned with respect to radioactive and chemical wastes.

Division of Laboratories

J. H. Neil, Director

The performance of chemical and bacteriological analyses and the carrying out of field and laboratory studies of a biological nature constitute the responsibilities of the Division. While no new staff were added to the complement during the year, improvements in techniques, skills and work organization permitted the handling of 14% more samples than in the previous year and 17% more analyses were performed. The new regional laboratory was established at the Lakehead and staffed by personnel transferred from Toronto. This facility was equipped for a wide range of chemical and bacteriological analyses and field equipment was provided for biological studies. (See Tables 1 & 2, Figs. 1 & 2.)

TABLE 1	Number of Samples		% Increase
	1968	1969	
Bacteriology	43,858	47,151	+ 8%
Biology	5,340	6,127	+14%
Chemistry I & II	57,478	68,961	+20%
Total	106,676	122,239	+14%

	Number of Tests		% Increase
	1968	1969	
Bacteriology	121,040	154,021	+27%
Biology	14,189	11,436	- 19%
Chemistry I	417,715	463,557	+11%
Chemistry II	28,291	53,325	+88%
Total	581,235	682,339	+17%

TABLE 2 Summary of Sample Sources Collected by OWRC Staff

Division	Bacteriology	Chemistry	Biology	Total	%
Sanitary Eng.	19,704	30,327	247	50,278*	41.1
Plant Operations	7,911	7,400	—	15,311	12.4
Research	103	8,517	160	8,780	7.2
Industrial Wastes	12	3,309	12	3,333	2.7
Laboratories	1,305	2,575	4,644	8,524	7.0
Water Resources	148	914	8	1,070	0.9
Other	7	—	—	7	
OWRC sub-total	29,190	53,042	5,071	87,303	71.3
Collected by Non-OWRC Agencies					
Municipal Agencies	15,515	9,460	814	25,789	21.8
Ont. Govt. Agencies	1,088	3,353	145	4,586	3.8
Private & Misc.	1,358	3,106	97	4,561	3.8
Non-OWRC sub-total	17,961	15,919	1,056	34,936	28.7
TOTAL	47,151	68,961	6,127	122,239	

* 16,762 of these samples were collected as part of the Great Lakes Program.

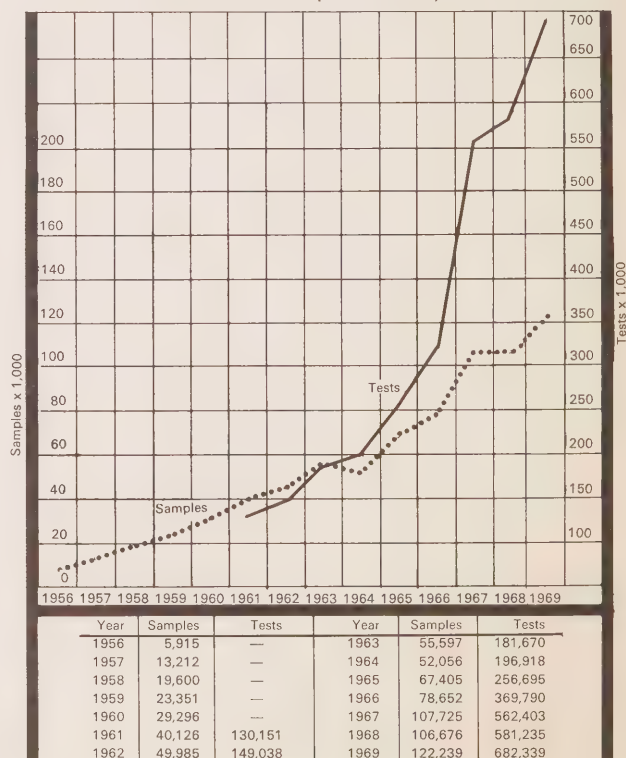
In recent years, scientific staff of the laboratory have taken an increasingly active part in field operations in support of the intensive survey work of other divisions. During 1969, a large mobile laboratory was located in the

Muskoka Lakes area, where it served as headquarters for the Biology Branch staff working on co-operative studies of these lakes with the Division of Research. Some 5000 chemical analyses of lake water were conducted in this laboratory, which also served as a headquarters for other lakes under study in the general area. A field laboratory was operated at Carleton University to support the work of the Division of Sanitary Engineering in its intensive survey of the Ottawa River. Another small mobile bacteriological laboratory worked in conjunction with vessels operating on the Great Lakes survey so that perishable samples could be handled with a minimum of delay.

A wide interest in the work of the Division resulted in many requests for visits to the laboratory. In 1969, thirty lectures, tours and conferences were handled by Division staff. These included science teachers' groups, post-graduate university students on field trips, professional and industrial groups, high school biology clubs and technical staff from municipalities and industries for instruction in the analysis of waste waters. The mobile laboratory staff at the Muskoka Lakes held a three-day "open house" which was attended by 600 people. Demonstrations were given on

Fig. 1

Annual Samples Received and the Number of Tests Performed. (1956-1969)

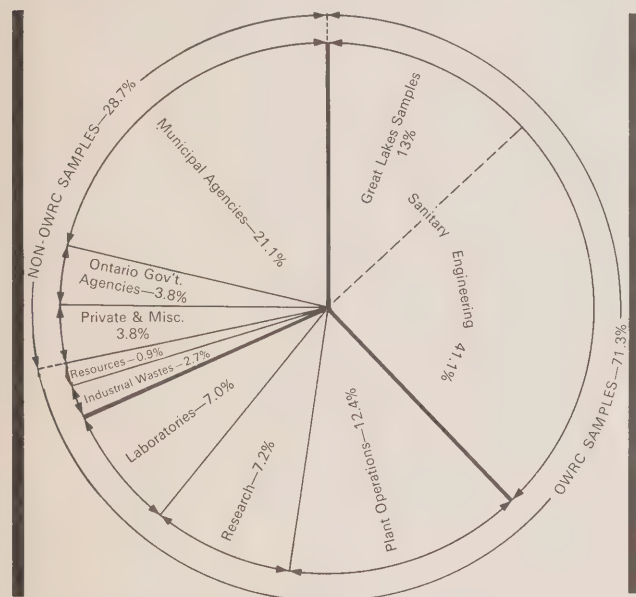


how water is sampled and tested. A collection of aquatic life, taken from the Lakes, was shown. A one-day conference was organized for all staff of the Commission regularly submitting samples to the laboratory. At this time, such items as the range of tests, precision and accuracy of analysis, special problems, costs, shipping and containers and other items intended to assist in the evaluation and selection of requests were covered and a manual distributed.

Chemists, biologists and bacteriologists, in addition to their regular assignments, worked on a number of formal committees, such as the Water Quality Objectives Committee, reported on specific industrial waste problems and regularly contributed a wide range of expertise to the ongoing water supply and water pollution control activities of the Commission.

Fig. 2

Summary of Sample Sources



BACTERIOLOGY BRANCH

The sources of samples submitted to the Branch remained much as in previous years, with the majority (62%) of the samples having been collected by OWRC staff. The Division of Sanitary Engineering accounted for 2,000 of the 3,000 sample increase recorded over 1968. Submissions from municipalities also increased by over 1,000, while private submissions decreased. A summary of sample sources appears in Figure 3. Samples increased 8% over 1968, totalling 47,151 for 1969. Determinations conducted on these samples increased sharply by 27% over the previous year, with 154,021 tests being performed. Table 3 shows a more detailed comparison. Drinking water and surface water analysis still formed the largest portion of the Branch's work. Figure 4 shows graphically the sample and analytical receipts since the formation of the Commission. The use of a wider variety of bacteriological parameters (as shown by numbers of determinations) to delineate pollution and enrichment of water has led to a better understanding of these problems.

Drinking Waters: A total of 80 municipalities submitted over 14,000 water samples, which were analyzed by the membrane filter (MF) or presence-absence (P-A) test or a combination of both tests. Summary reports were prepared quarterly, which detailed the number of submissions and samples plus frequency of positive results for each municipality. Low and high coliform and background counts for each quarter were listed, along with the types of pollution indicator organisms found in the raw water samples. About 30% of all samples gave presumptive positive P-A results; 7% were positive for coliforms, 2.8% for fecal coliforms, 1.9% for fecal streptococci, 1.5% for clostridia and 0.4% for pseudomonas bacteria. An article, comparing MF and P-A tests, was published in the July issue of the Canadian Journal of Microbiology.

Meetings were held with Plant Operations' staff and District Engineers' staff to discuss bacteriological analyses and interpretation of results. Instruction in MF and P-A procedures was given to laboratory personnel from the Hamilton Municipal Laboratory, the Green Giant Company, and the OWRC London Laboratory. A number of visitors to the laboratory were given information on the Commission's bacteriological procedures for drinking water analyses.

Information on statistics compiled by the Branch for monthly reports, annual reports and budget submissions, was prepared for the Systems and EDP Branch.

Great Lakes Water: The one-year daily study of Toronto Harbour and adjacent areas of Lake Ontario was completed. The study was undertaken to investigate the seasonal and daily variation of the various standard parameters with the aim of evaluating the relationship of the parameters and the significance of limited sample surveys in defining water quality. This study provided further information on the relative distributions of different types of heterotrophic bacteria, in addition to those of sanitary significance in the aqueous environment. A preliminary report on the results of three-quarters of the study (July to March) was prepared and presented at the Twelfth Conference on Great Lakes Research. The full report is now nearing completion. A member of staff will take a closer look at yearly parametric trends, their interrelationship, and the effect of meteorological conditions. A combined report, incorporating the concurrent chemical and biological sampling results, will be prepared. Summary reports of results were prepared following the completion of individual surveys. Twenty-nine such reports were prepared in 1969. The inauguration of new bench sheets paved the way for faster computer input. Future summaries will be done by the Systems and EDP Branch.

Extensive use was made of the two mobile laboratories, one of which became operational in July after being rebuilt for bacteriological work. Some of the surveys on which these laboratories were used were the St. Mary's River, Manitoulin Island, St. Lawrence River, Bruce County, Lake Huron, Georgian Bay and North Channel surveys. The use of mobile facilities increased the efficiency and accuracy of bacteriological testing by providing immediate analysis of perishable samples.

Fig. 3
Summary of Bacteriology Sample Sources

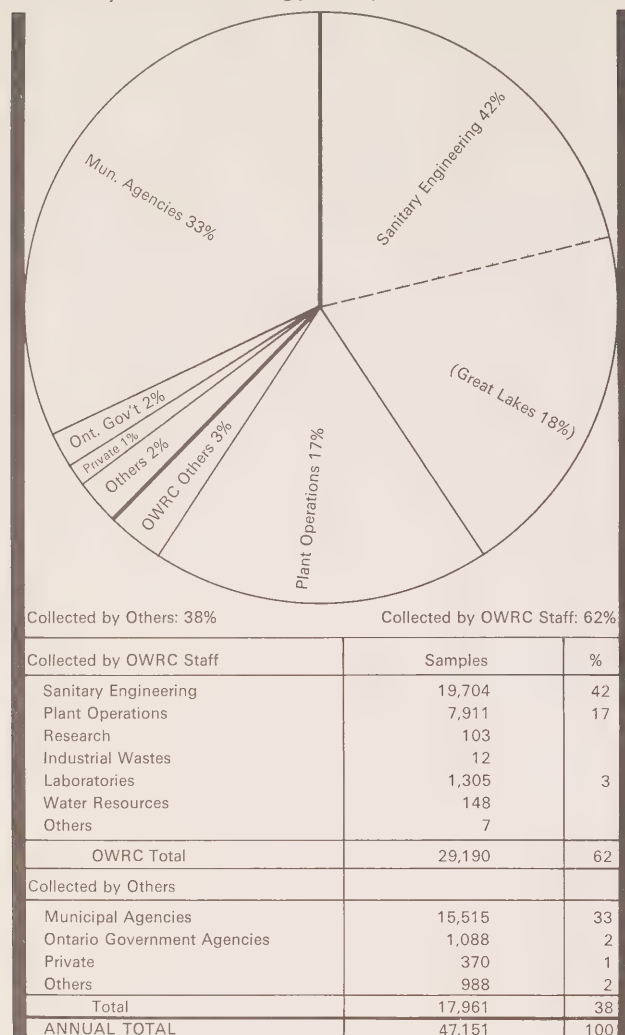


TABLE 3

Comparison of Sample and Test Statistics for 1968 and 1969.

	1968	1969	Increase	
			No.	%
Drinking Water Samples	24,764	25,641	(877)	4
Surface Water Samples	16,070	18,375	(2,305)	14
Sewage and Waste Samples	2,867	3,034	(167)	6
Miscellaneous Sample	157	101	(-56)	—
Total Samples	43,858	47,151	(3,293)	8
Total Determinations	121,040	154,021	(32,981)	27
Great Lakes Samples	7,519	8,430	(911)	12
London Lab. Regional Samples	3,469	3,461	(-8)	0
Lakehead Regional Samples	—	961		
Samples Unsuitable for Analyses	156	248		

A report on an intensive survey in Western Lake Erie carried out in 1968 was completed. The report showed that small intensive daily data were more valuable than those from monthly or weekly surveys.

The distribution and types of heterotrophic bacteria in the Great Lakes was studied and a report was prepared. The genus *Acinetobacter* emerged as a significant organism that responded to enrichment of the environment.

Surface Waters: In order to assess the significance of *Clostridia* in surface waters and drinking water supplies, a scheme of classification, based on a battery of biochemical tests, was devised. The scheme encompassed all species reported in current literature. Cultures were tested according to this classification scheme with moderate success.

A survey of Penetang, Midland and Port McNicholl bays was carried out from May through October in conjunction with the Biology Branch. Samples were bacteriologically analyzed for five standard and two experimental parameters. In addition, plate count isolates were identified and classified. An intensive bacteriological survey of the area was carried out during July. Data obtained from the survey are being evaluated, correlation of various parameters attempted and a report is being prepared. Isolates of the family Enterobacteriaceae from this survey are being further studied since many were aberrant types not conforming readily to classification.

Work dealing with the importance of iron and sulphur-oxidizing bacteria in water pollution by wastes from uranium mining activities in the Elliot Lake region was carried out in co-operation with the Division of Research. A detailed bacteriological report on these findings was prepared and will be incorporated into the complete general report on the Elliot Lake investigation.

In conjunction with a biological survey of the Matawin River watershed, populations of sulphur and iron bacteria in water and sediment of Pewatai Lake were determined periodically during the summer.

A study of the distribution of sulphur-utilizing bacteria in the water and sediments of the Ottawa River and bacterial interactions with pulp and paper mill wastes was completed. In addition, this survey concentrated on bacterial parameters of ecological and public health significance in municipal, industrial and recreational areas of the river. Reports are under preparation.

Regional Laboratories: The bacteriological section of the London regional laboratory analyzed 3,461 local samples and 3,833 Great Lakes samples, totalling 7,294 samples in 1969. This represents a slight increase over the 1968 workload.

The P-A test was introduced for drinking water sample analysis, and local surface water samples are to be routed to this laboratory early in 1970.

Bacteriological laboratory facilities were opened in 1969 at the Lakehead regional laboratory. A total of 961 samples were analyzed for coliform bacteria. The technician performing analyses will be trained to use other bacterial techniques early in 1970 so that a more complete analytical service can be provided.

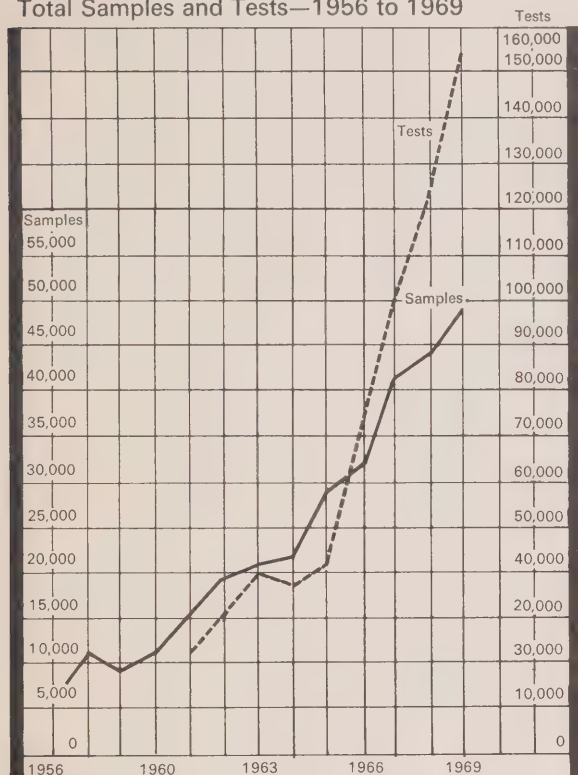
General: Scientists from other provinces and countries visited the laboratory; meetings, symposia, conferences and

courses were attended. Addresses were given to a variety of groups and lectures were presented to Water and Sewage Works Operators courses.

Microbiological bathing water, drinking water, clear surface water and agricultural water standards and characteristics were re-assessed and investigated. They were updated and newer information was incorporated. An investigation into the presence of *Salmonella* organisms in a hospital discharge was made. Organisms producing rusty water, tastes and odours, slimy growths in water mains and streams and those causing bulking in sewage treatment plants formed an important part of the workload.

Fig. 4

Total Samples and Tests—1956 to 1969



BIOLOGY BRANCH

The activities of the Biology Branch encompass both field and laboratory studies and investigations. The total program of the Branch is designed to clarify pollutional effects of industrial and municipal discharges, enrichment phenomena associated with nutrient increases in lakes and rivers, effects of pesticides and other toxic materials in the aquatic environment and evaluation and regulation of chemicals and other aquatic control agents used to enhance multiple water uses through the control of excessive algae, aquatic vegetation and other nuisance conditions.

Biological Surveys

Biological surveys were completed both on a major scale and on a less intensive scale during 1969 to provide information for the development of sound water use plans

for entire river basins in the former case, and in the latter case to demonstrate the effects of specific pollution sources on the receiving water.

Major watershed surveys were carried out on the Nith River and the Ottawa River, the latter being a continuation of a survey commenced in 1968 in co-operation with the Water Quality Surveys Branch of the Division of Sanitary Engineering and the Quebec Water Board. The Nith River survey entailed the evaluation of phytoplankton, bottom fauna and fish populations to assess the impact of industrial and municipal waste discharges on the river and its tributaries. The 1969 program on the Ottawa River included intensive studies between lower Lake Timiskaming and Mattawa and sampling on a more extensive basis on Holden Lake, Allumette Lake, Lac des Chats and Lac Deschenes. Fish were collected for flavour evaluations and mercury analyses, with reference to the potential effects associated with pulp and paper mill discharges.

A pre-operational survey was completed on streams, rivers and lakes of the Matawin River system to provide background information prior to the development of mining and concentrator operations near Lake Shebandowan. Bottom fauna and fish populations in Ministic Creek were evaluated prior to the opening of Agnew Lake Mines which will discharge tailings decant to this stream. Sampling of bottom fauna and phytoplankton continued on Lake Erie near Nanticoke in order to obtain pre-operational data in connection with the development of a thermal generating station by Ontario Hydro and a steel plant being established by the Steel Company of Canada Limited. Post-operational studies were completed on Tetapaga Creek (Sherman Mines development) to permit comparisons with data obtained in 1967 and 1968. Field investigations were completed in connection with evaluating the effects of uranium mining and milling wastes in the Elliot Lake and Bancroft areas. A preliminary draft of the report for this three-year program was completed and will be integrated into a final report encompassing the results of investigational work carried out by several divisions of the Commission.

Biological surveys were carried out on Lake Superior in Peninsula Harbour and Moberly Bay to establish the impact of kraft process wastes from paper mills at Marathon and Terrace Bay, respectively. Bottom fauna were examined along the Rainy River as part of a surveillance survey developed under the auspices of the International Joint Commission. Effects of municipal wastes were evaluated in Penetang Bay and Midland Harbour and background conditions were determined prior to a change from septic tanks to a secondary treatment plant at Port McNicoll. In co-operation with the Department of Lands and Forests at Sudbury, a monitoring program for pH and conductivity was carried out to determine possible relationships between smelter fallout, reduced pH and a reported decline in fish reproduction in the Lang Lake chain.

Less intensive spot and surveillance surveys were carried out to monitor water quality conditions associated with industrial or municipal discharges to Bruce Lake, Durn Lake, Lake Ontario at Port Hope and the Thames River at St. Mary's.

Surveys of the presence of DDT residues in aquatic biota were carried out in the Bay of Quinte and lower Trent River system, the Holland River and Cook Bay and the Muskoka Lakes system. In addition to fish, samples of water, sediments, bottom fauna, plankton and vegetation were collected for analysis. Bottom fauna evaluations were completed throughout an experimental area where the Forestry Branch of the Department of Lands and Forests was testing the insecticide fenitrothion for spruce budworm control. In co-operation with the Sea Lamprey Control Unit of the Federal Department of Fisheries, evaluations of the effects of the lampicide Bayluscide on aquatic invertebrate life were completed at Solar Lake on the Echo River system.

Biological survey reports were completed during the year for 1968 surveys on the Moira River, Sydenham River, Abitibi River, Wabigoon River, Canagagigue Creek, Port Hope harbour (preliminary) and Silver Lake. A report on a 1968 investigation of biological parameters at two Lake Ontario locations near Toronto was prepared and a related address was delivered at the Great Lakes Research Conference. In co-operation with the Division of Research, a report entitled 'Effects of Acid Mine Wastes on Phytoplankton Communities of Two Northern Ontario Lakes' based on data collected during the Radiological Investigations Program at Elliot Lake was completed.

Aquatic Enrichment

Studies related to assessments of the eutrophication status of provincial waters were carried out for a number of purposes. A co-operative program was established with the Division of Research in order to determine the current level of enrichment throughout the Muskoka system and to establish causative factors for increases in nutrient levels. This work involved regular sampling of phytoplankton and water chemistry conditions, carbon₁₄ uptake studies to assess primary productivity, algal bioassays in plastic bags in the lake and laboratory assessments of algae growth potential. Observations on *Cladophora* growths along the Lake Huron shoreline from the Bruce Peninsula south to Kettle Point were made and mapping of growth beds was completed off municipalities such as Goderich, Southampton, Port Elgin and Kincardine. Samples for phosphorus and nitrogen analyses were obtained regularly in an attempt to establish nutrient correlations with observed algal conditions. Seventeen municipalities along the Great Lakes system between Goderich and Brockville continued to send in weekly samples for phytoplankton analyses. This program is designed to reflect the effectiveness of future nutrient control measures in offsetting an acceleration of the eutrophication process. Assessments of the present productive status of three recreational lakes were made — Lake Bernard (Sundridge), Silver Lake (Port Carling) and Riley Lake (near Orillia). These studies were carried out to determine the need for improving the containment of cottage wastes. In addition, the quality of Lake Bernard was considered from the standpoint of use as a municipal water supply for the Village of Sundridge.

A number of studies were completed to evaluate

phytoplankton conditions relative to water supply sources. Sampling was carried out in Lake Ontario at Cobourg to determine the optimum water intake location. Taste and odour studies, necessitated by algal conditions, were carried out at St. Thomas, Orillia and Belle River. Summary reports based on samples submitted by municipalities along the Great Lakes in connection with the Provincial Phytoplankton Inventory Program were forwarded to twelve municipalities.

Evaluation programs pertaining to aquatic nuisance control measures received attention, several being extensions of programs commenced in 1968 or earlier. Co-operative efforts continued with Ontario Hydro in evaluating effects of blackfly larvicides on non-target organisms and to compare relationships between effectiveness of treatment and physical characteristics of different streams. Several chemical formulations were tested in a five-acre area in Rice Lake to test their effectiveness in controlling mixed submergent vegetation. A broad-scale survey was conducted between May and September in Rice Lake in an effort to determine the natural succession of aquatic plants in this highly productive body of water. Studies in farm ponds north of Metropolitan Toronto were carried out to test a number of herbicides against various species of aquatic plants and algae, and a three-year study designed to establish effective application rates, optimum treatment time and regrowth potential for four cattail control agents was finalized. The Branch co-operated with the Research Branch of the Department of Lands and Forests in a study designed to evaluate relationships between excessive aquatic vegetation and fish production.

A thorough investigation of the swimmers' itch problem was conducted during June and July at Golden Lake, near Pembroke. Distribution of snails harbouring the swimmers' itch parasite was plotted, as was the incidence of infection by trematode larvae, and these factors were correlated with dermatitis outbreaks along the lake. Results of the study were used to provide control recommendations for cottagers and shoreline residents.

The number of permits issued to authorize the use of algicides, aquatic herbicides, mosquito and blackfly larvicides and other aquatic nuisance control agents reached 219, an increase of 34 over 1968. Approximately 700 enquiries were answered, providing information on permissible control procedures. A new pamphlet 'What To Do About Weeds In Your Lake' was prepared to better acquaint the public with the permit requirement and to inform them of the literature available on nuisance control procedures. A representative of the Branch acted as an aquatic specialist on the Ontario Herbicide Committee and as a convener of the aquatic section for the annual publication of the National Weed Committee.

Fish Toxicity Studies

Fish bioassays were completed on 85 samples, involving a total of 5,025 tests, including supporting chemical and physical measurements. The tests included surface water samples, industrial wastes, pesticides and miscellaneous chemicals. Major fish toxicity evaluation reports were

provided for Domtar Limited (Redrock), Liquid Carbonic Canadian Corporation Limited, Union Carbide Canada Limited, and for tests of oil dispersants and gas well fracturing compounds.

A total of 59 fish kills were reported for the year. A breakdown of causes of these fish mortalities is as follows: industrial wastes 21, pesticides 5, natural causes 31 and unconfirmed 2.

A breakdown of the samples received and determinations completed throughout the year is as follows:

Summary	Samples Received		Determinations Completed	
	1969	1968	1969	1968
Algae counts	2,686	2,839	1,530	2,668
Identifications	104	137	117	237
Threshold odours	105	162	102	143
A.G.P. Samples	30	64	893	171
Bioassays	85	155	5,025	8,260
Pesticides	392	484	488	942
Zooplankton	511	168	31	51
Bottom fauna	1,587	1,277	2,597	1,041
Plants	65	18	19	18
Taste tests (fish)	21	32	—	192
Permanent slides (algae)	218	—	573	462
Diatom counts	—	—	18	—
Fish (identification and preparation)	91	—	43	—
Sediments	232	—	—	—
Miscellaneous	—	4	—	4
Total	6,127	5,340	11,436	14,189

CHEMISTRY I BRANCH

Progress was made in a number of important areas pertaining to the chemical analysis of drinking water, waste water and receiving waters. While no new staff were added, a record number of samples were processed, new analytical techniques were introduced, a new regional laboratory was established, and improved procedures were developed which shortened the overall time required to process samples.

An increase was noted in requests for analysis reports suitable for use in court actions by OWRC field staff and by private individuals and agencies. The procedures for receiving, analyzing samples, and the preparing of analytical reports according to legally acceptable methods, require special care and thorough validation. Analytical reports from the laboratories assisted in gaining convictions in many pollution problems, ranging from major industrial sources to drinking water supplied to penned dogs. In further cases, for which analytical evidence has been prepared, trial is still pending.

Analytical methods development is a continuing part of Branch activities. Techniques for the use of the AutoAnalyzer in nutrient analysis were refined to further improve precision and lower the limits of detection. Exploratory testing to compare various instrumental techniques for the analysis of iron, fluorides and turbidity allowed an informed choice of instruments to be made.

A potentiometer and ion electrode were selected for use in fluoride analysis and this new method is expected to be introduced as a standard analytical procedure during the

1970 season. This will enable the present distillation procedure required to purify samples to be discontinued, freeing needed space and reducing the unit cost of the fluoride test.

An Atomic Absorption Spectrophotometer was purchased and techniques for the analysis of iron, calcium and magnesium employing this instrument are now being developed. It is planned to have this unit operational by spring of 1970, at which time the present hardness test can be discontinued, and replaced by the individual calcium and magnesium determinations.

A new turbidimeter which showed promise of detecting low levels of turbidity, as required by the revised drinking water objectives, was required for evaluation. These turbidimeters will be adopted for use prior to the peak 1970 sampling period.

Development of improved precision and accuracy in analysis was pursued during 1969. This included staff attendance at statistical evaluation courses, performance of tests in replicate, circulation and comparative analysis of reference samples throughout all laboratory sections, improved analytical checking procedures, and close mathematical evaluation of mineral analyses to ensure that theoretical 'balances' were in fact obtained. Reference samples analyzed for the United States Public Health Service included evaluations of present and new methods for the analysis of nutrients (six tests for various chemical forms of nitrogen and phosphorus) and comparative analyses of samples for conductivity, dissolved solids, pH and alkalinity.

Further improvements were made in analytical reporting procedures. The deadline for completion of all tests on water samples was reduced to one week from sample arrival, and for pollution tests on sewage and river samples to two weeks from sample arrival (recognizing that nearly all these samples require BOD tests involving a five-day incubation). These deadlines are now being met consistently. A new system of filing analytical reports prior to completion, and of reporting analytical values obtained, was planned for introduction in 1970, and is expected to further improve the efficiency of reporting procedures.

Special Projects

Much progress was made early in the year in preparing detailed plans for laboratory layouts in the proposed new laboratory building, prior to a postponement of further action on this project.

Renovations in the laboratory to provide for the safe handling of mercury in the daily testing for BOD proved to be satisfactory. An inspection was made, and subsequent air samples collected for mercury analysis by the Industrial Hygiene Laboratory of the Ontario Department of Health at the Branch's request were found to be well within acceptable limits. Regular medical examinations of all exposed employees have been arranged.

To assist field staff in the selection and evaluation of tests requested on incoming samples, a compilation of brief descriptions of each routine test method, together with comments on its relevance, evaluation, precision, cost, and

sampling precautions, was prepared in brochure form. Information on required volumes of sample and on shipping and receiving procedures was included. An initial edition of this brochure was distributed at a meeting among laboratory and field staff in the spring of 1969. Participants had the opportunity to discuss and resolve mutual problems and agreed that future annual or bi-annual meetings would be advantageous. An amplified edition of the brochure has been prepared and will shortly be distributed.

An investigation of daily chemical variations in water quality in and near Toronto Harbour, begun in 1968, was completed, and together with bacteriological and biological results, was presented as a preliminary report at the 12th Conference on Great Lakes Research.

Laboratory staff continued work on development of methods of sediment analysis and quality evaluation. Samples were supplied by the Division of Research as part of a eutrophication study in Lake Muskoka and by the Department of Lands and Forests and the OWRC Biology Branch in conjunction with their plant ecology study. Reports will be prepared in cooperation with these groups.

Staff assisted in developing terms of reference for a Laboratory Data Handling Study, undertaken by personnel from the Systems & EDP Branch. One of the aims of the study is to develop faster and more efficient procedures, at reasonable cost, for expediting sample analysis and reporting.

Standard reference samples were distributed to the main Toronto Laboratory and to the regional laboratories as part of a continuing program of analytical quality control. With the advent of a regional laboratory system, frequent reviews of analytical precision and accuracy are necessary to maintain uniformly high quality work performance.

Staff assisted in editing the Report to the International Joint Commission on the Pollution of Lake Erie, Lake Ontario and the International Section of the St. Lawrence River. A summary of OWRC analytical procedures used for obtaining Great Lakes data was submitted for inclusion in the Appendix to the Report.

Total Tests Performed

Although year to year variations in the difficulty of tests performed may have a slight influence, the test totals are the best guide as to productivity. Overall, the Chemistry I Branch achieved an 11% increase in tests performed. The individual section contributions to this total are tabulated marginally, and reveal the increasing contribution made by the regional laboratories.

Great Lakes Laboratories

The Division of Laboratories operated field laboratories in London and Toronto to provide analytical services for the International Joint Commission Great Lakes Project. Samples were submitted from Lake Ontario, Lake Erie, Lake Huron and the inter-connecting channels. A sample freezing technique, first introduced in 1968, was again used to minimize loss of perishable constituents prior to sample analysis.

A cooperative study, involving the OWRC and other Canadian and American agencies engaged in the Great Lakes Program, was undertaken to determine the factors which influence the measurement of phenol in Great Lakes' waters.

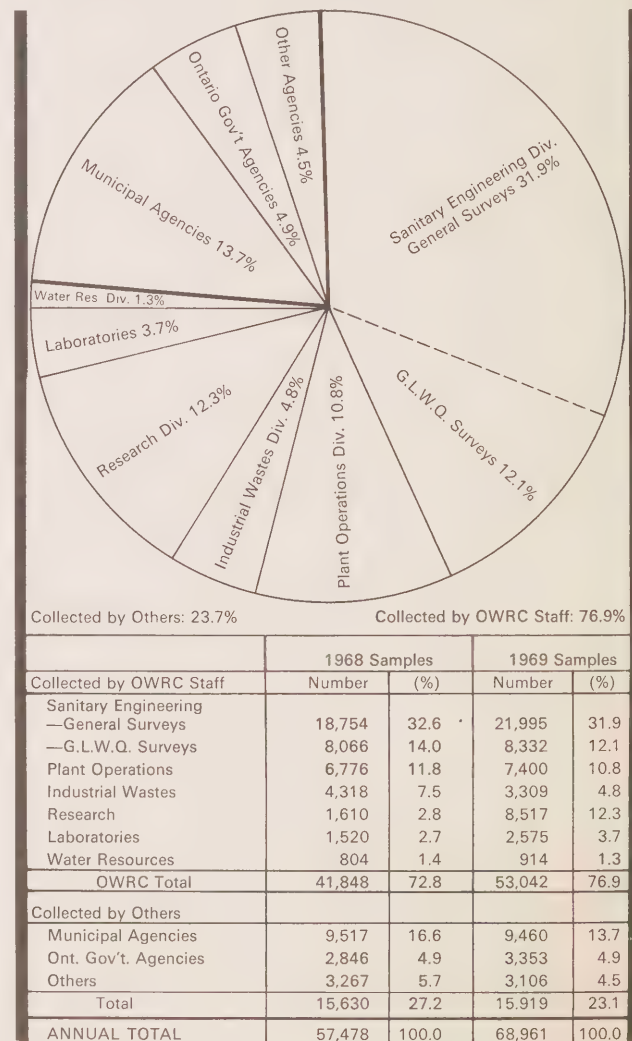
The number of Great Lakes samples analyzed totalled 8,332, an increase of 3% over the previous year's total. Tests performed totalled 89,776, a 5% increase compared to 1968.

As was the case in previous years, all the analytical data generated by the Great Lakes Program were reported in a format suitable for computer storage and retrieval.

Regional Laboratories

The London field laboratory was also used for handling routine samples from the London region which otherwise would have been processed at the main laboratory in Toronto. The number of regional samples received in London during 1969 totalled 3,962, a 30% increase

Fig. 5
Summary of Chemistry Sample Sources



compared to 1968. Tests performed amounted to 19,982, a 45% increase over 1968. The increase in productivity was mainly brought about by the acquisition of additional automated equipment.

Plans were drafted to integrate the London laboratory and office functions, both presently located in separate temporary quarters in the London area.

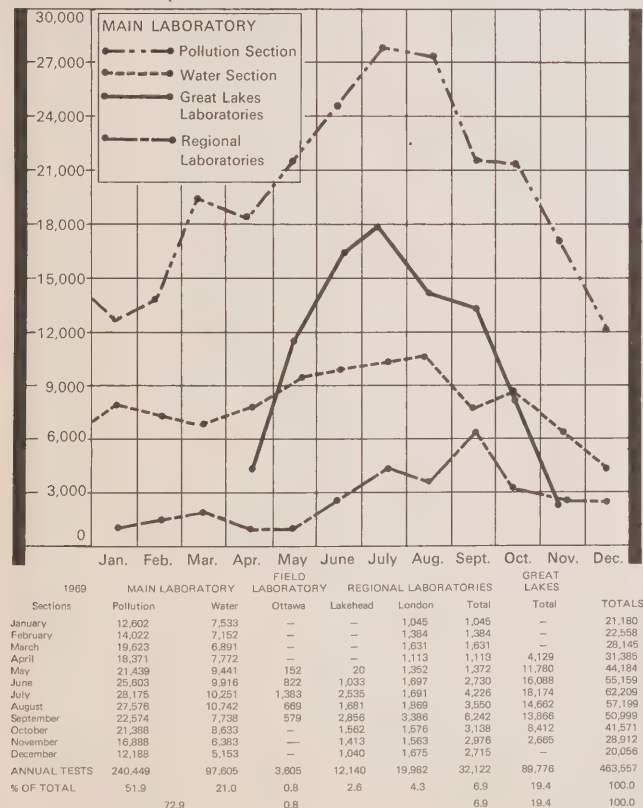
A new regional office, consisting of laboratory and office facilities, was formally opened on May 29th, 1969, at the Lakehead. The office is manned by staff from field divisions and by personnel from the laboratory division. The laboratory is equipped to handle all routine water and pollution analyses for the Lakehead area. The Lakehead laboratory-office complex is the first integrated divisional field unit established by the Commission. Closer liaison between staff from the various divisions is possible with this type of unit, resulting in more efficient use of the available technical resources and better service for the public at large. Future regional offices will doubtless be patterned after the Lakehead unit.

The Lakehead laboratory received 1,309 samples in 1969, requiring 12,140 analyses. During the course of the year, analytical support was also given to the Commission staff engaged in the International Joint Commission Rainy River Survey.

Ottawa Laboratory

A field laboratory was again established to provide on-site

Fig. 6
Water and Sewage Analysis
Section Tests
Totals Monthly—1969



laboratory facilities for the completion of the Ottawa River Survey. This year the laboratory was located in quarters at Carleton University. Upon completion of this assignment, staff were transferred to assist in on-site laboratory work for the International Joint Commission Rainy River Survey.

The sources of samples received by both Chemistry branches for chemical analysis are indicated in Fig. 5. Fig. 6 indicates the monthly tests completed by Chemistry I in the main, regional and field laboratories.

CHEMISTRY II BRANCH

In a year marked with many highlights, perhaps the most significant development was the remarkable increase in the number of tests performed. More than 53,000 tests were completed in 1969, representing an increase of 88% over 1968, (Fig. 7). This was the most significant growth since the Chemistry II Branch began operations as a separate unit in 1965 (Fig. 8).

The increase in number of tests was accompanied by a widening of the scope of the analytical work. Ninety different types of analyses were performed, plus numerous special tests used in identifications and detailed analysis of carbon filter extracts. This resulted in nearly 50% more variety than in 1968. The growth in production was not without quality gains. Improved methods and techniques helped in providing more reliable results and more detailed information in much shorter analysis time than was possible before.

The increase in requests was caused by the following: increased survey work by various branches, especially the Muskoka Lakes and Pewatai Lake surveys, the water quality survey which resulted in requests for all the parameters mentioned in the "Ontario Drinking Water Objectives"; analytical support for Biology Branch and Division of Research projects; increased demands for analysis of toxic pollutants such as mercury, polychlorobiphenyls, etc., and the increased need for reliable support data for court actions.

The above factors contributed to the large number of tests requested. There was an increase in practically all types of samples, although the most significant as a group was the river series.

In order to cope with this increase while continuing the developmental work vital to future requirements, the laboratory had to make the following arrangements: accessories were added to existing equipment, extending their range and output; several new instruments and smaller items were purchased; and instruments of the Division of Research were made available to the Branch.

Factors other than equipment effected the increased output. Formation of work groups, growth of know-how, maturation of past development projects, and improvements in relations with operating and other groups all contributed to a significant increase in work efficiency. The increase from 5.9 to 8.8 tests per man per day is an increase of nearly 50%.

Inorganic Analysis

The inorganic laboratory completed 32,582 tests in 1969, 37

an increase of 114% over 1968. With increased technical knowledge and equipment additions, the efficiency rose from 6.2 to 10.3 tests per man per day.

Several specific events that occurred during the year influenced the quantity and quality of the analytical work. The inorganic laboratory participated in a number of special surveys, ranging from the survey of municipal water supplies to surveys of entire river systems, such as the Pewatai and Muskoka systems. A large number of iron, calcium and magnesium tests were performed for the Chemistry I Branch.

The inorganic laboratory was also involved in several special projects. The most important of these involved studies of interferences on the atomic absorption spectrophotometric and colorimetric methods, a study of the effects of storage conditions on the trace metal content of waters and waste waters, a study of preparation methods for samples requiring trace metal analyses, and the identification and determination of trace amounts of alkaline metals and earths in water. The latter involved development of atomic absorption spectrophotometry methods for lithium and barium, and considerable interference work was necessary for reliable magnesium and calcium analyses.

Special studies were also carried out in connection with environmental pollutants like mercury and selenium. These metals were the subject of very extensive literature reviews, reports and method revision. Methods for the analysis of higher selenium concentrations were devised using both atomic absorption spectrophotometry and polarography, while analyses were performed at lower concentration by a fluorometric procedure.

New methods were developed for the determination of a number of metals — uranium, vanadium, selenium, and aluminium, to name a few. In addition, several metals were added to the list of elements for which the Chemistry II Branch performs analyses, including germanium, molybdenum and lithium.

In addition to these special projects, the laboratory was also involved in several international surveys of analytical procedures. Methods for analyzing aluminium, copper, manganese, and iron were examined for the Analytical Reference Service Program of the Department of Health, Education and Welfare, Public Health Service, Cincinnati, Ohio, and aluminium tests were performed for the Method Survey program conducted by the Water Research Association, Medmenham, Bucks., England. The inorganic laboratory ranked among the top five laboratories in all of these studies.

Organic Analysis

The 58% increase in tests performed by the organic laboratory produced a comparable increase in tests per person per day. The increasing variety in the tests requested indicates the growing interest in organic pollutants.

This increase in analyses performed was possible because many tests previously performed on an individual basis became routine. The total organic carbon determinations, pesticide analyses, tests for hydrocarbons, etc., were performed in large numbers and together with established routine

tests (phenols, ether extractables, etc.) constituted the bulk of the tests completed.

The characterization of organic micropollutants recovered by the carbon filter technique continued and this technique was especially useful in detecting specific toxic organics in wastes at Elmira. The carbon filter program on the Great Lakes was extended by installing a new unit at Cornwall.

The chief activities of the chromatography laboratory were: analysis of water and biological matter for chlorinated pesticides; investigation of interferences by electron capturing materials — possibly polybichlorinated biphenyls — in many of the Biology Branch samples; development of gas chromatographic methods for oils and fats as well as for identification of petroleum products, solvents, and waxes; characterization of dairy wastes through lactose and lactic acid; and the determination of sugars, amines, fatty acids and non-ionic surfactants by chromatography.

Colorimetric techniques were used to determine alcohols, formaldehyde, lauryl sulphate, etc. Humic acid type materials were isolated by column chromatography and determined by spectrophotometry. The electrophoretic technique was applied for protein characterization.

The spectroscopy group performed a large number of routine examinations of infrared spectra obtained in the Carbon Filter program and a series of other samples were analyzed for oils, greases, petroleum products and other industrial pollutants.

There was a notable increase in litigation this year, requiring cooperation among various groups in the laboratory. The main tool in this work remained the infrared machine, although in several cases other techniques such as gas chromatography provided additional supporting evidence.

In conclusion, 1969 was a year of gratifying productivity

Fig. 7
Total Monthly Tests Performed.

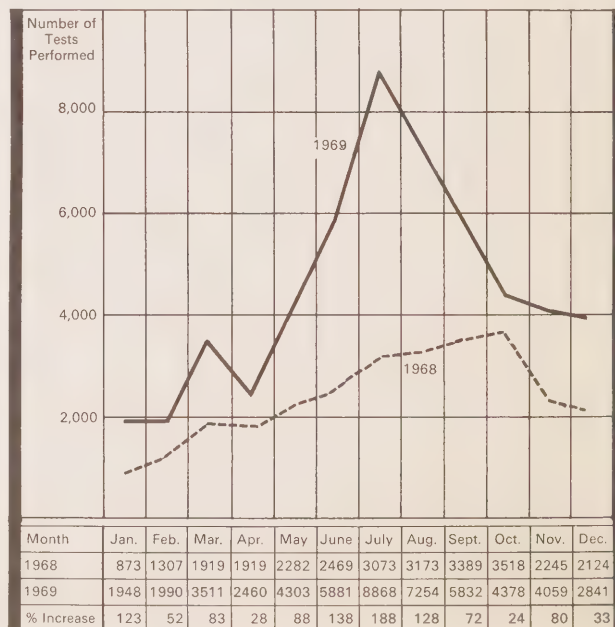
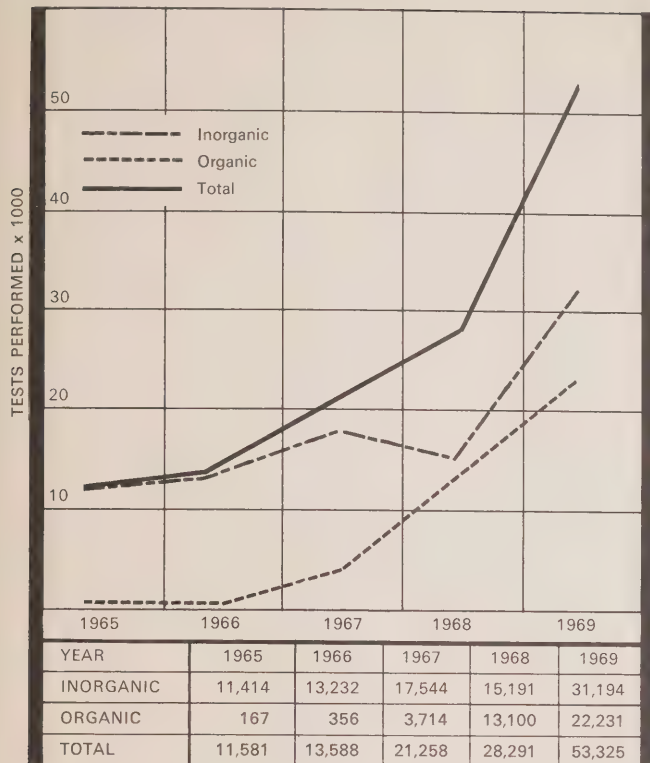


Fig. 8
Tests Performed 1965-1969



and progress in every area of industrial waste analysis. Next year many of the tests performed intermittently in the past will become routine and some of the routine tests will likely be adapted for automation. Proven techniques will be extended to new areas, and new techniques will be introduced for specific tests. The demand for improved accuracy, precision and sensitivity will increase, especially for the detection and determination of toxic elements and compounds. The increased demand for specific, complex tests will require extensive method development work and application of sophisticated techniques. In summary, the trend for 1970 will primarily be a deepening in analytical capabilities, rather than further increase in numbers.

Division of Plant Operations

D. A. McTavish, Director

C. W. Perry, Assistant Director

The Division of Plant Operations supervises the operation of all water and sewage works financed and constructed by the Commission. By the end of the year, there were 333 projects operating in 207 municipalities and 7 industries (municipal: 128 water, 186 sewage; provincial: 9 water, 10 sewage). A total of 330 operators were on staff at the year end.

ADMINISTRATION

The Division becomes involved in each new project during its design stages. Reports, plans and specifications submitted by consulting engineers are reviewed by the Division, in conjunction with other divisions, to ensure the provision of suitable works. The Division is also responsible for investigating enlargement of existing projects, where conditions demand such enlargement.

For purposes of administration, the Province is divided into six regions, projects in each region being the responsibility of a regional operations engineer. The latter prepares estimates of the operating costs, determines staff requirements and maintains liaison with local officials. He also ensures that adequate preventive maintenance of equipment is practiced and that the plant process provides the maximum possible treatment.

The operations engineer reports to a supervisor, who, by participating in the development of the policies established at divisional level, ensures a high standard of operation.

Major provincial projects are supervised by engineer-managers, who ensure that adequate maintenance programs and process control are provided. They are also responsible for initiating expansion programs, and establish and maintain communication with present and prospective participants. The engineer-managers also report to a supervisor.

A maintenance section, consisting of mechanical and electrical technicians and technologists, assists the operations engineer and engineer-manager in establishing adequate maintenance programs. A project services section, including a statistical group, assists in process problems and maintains data on project operation.

PROJECT SERVICES SECTION

The project services section investigates operating field problems, evaluates operating results, appraises new chemicals and processes, reviews plans and specifications for certain new projects, and prepares special reports for the Division. The project services engineer also supervises the activities of the Division's statistical and brochures sections and, in addition, acts as the Division's liaison officer with the Systems and Electronic Data Processing Branch.

During 1969 process and sampling statistics on 195 39

projects were maintained by the statistical section. The brochures section prepared copy material for 56 annual operating summaries, which were subsequently printed and distributed. In addition, the brochures section produced a general news bulletin and a maintenance bulletin for plant operators at regular intervals.

Papers prepared by the project services engineer were presented at the Chief Operators' Conference, the Sewage Works Operators' Course and the Water Works Operators' Course. The project services section also prepared and printed summary reports on the operation of water pollution control plants, water treatment plants and waste stabilization ponds operated by the Division.

The section provided training in laboratory techniques for field personnel at a number of plants, and assisted in establishing new or improved laboratory facilities at four plants.

MAINTENANCE SECTION

High standards of maintenance and a preventive maintenance program ensure continuity of services at all water and pollution control facilities and also protect the Commission's capital investment.

The technical services group, consisting of qualified technologists and technicians reporting to the Maintenance Engineer, provides a service function to the Division. This group is responsible for the continuing development of the overall maintenance program and for assisting the operations staff in its implementation. The group's primary services include troubleshooting, planned repair, inspections, modifications, contract maintenance supervision, engineering, and training.

Project maintenance assistance and coordination of project preventive maintenance is provided by the regional Maintenance Technician-Coordinator who reports directly to the regional Operations Engineer. Close liaison between the regional operations staff and the Technical Services Branch results in a province-wide standard but flexible maintenance program. A reporting system permits continuous evaluation of the maintenance program.

EQUIPMENT EVALUATION

The maintenance reporting system offers the basic information required for the evaluation of equipment. A manual correlating system provides evaluation data which is used in the selection of materials and equipment for new projects. In the future, it is proposed that this will be accomplished by electronic data processing.

SAFETY

The safety program of fire fighting and air pack drill was enlarged in 1969 to include fire protection with active chemicals other than chlorine.

Lectures on safety were given at AWWA area conferences held in Welland and Stratford.

New operators in Eastern Ontario attended a gas and oil course conducted by the Department of Energy and Resources Management and received their certificates in

this field.

There were no fatalities or permanent injuries in 1969.

The following comparative table for the years 1963 to 1969 shows disabling injuries, frequency and severity rates of accidents:

Year	Disabling Injuries	* Frequency Rates	** Severity Rates
1963	6	17	180
1964	11	25	440
1965	13	33	351
1966	14	26	256
1967	9	17	260
1968	22	37	740
1969	18	29	496

* Disabling injuries per million man-hours worked.

** Man-days charged to disabling injuries per million man-hours worked.

MAJOR PROVINCIAL WORKS

Lake Huron Water Supply System

The project comprises a treatment plant, a main pipeline and two branch pipelines. Flow to the major consumer, the City of London, increased by 9% over 1968. Grand Bend, Parkhill and the Township of London were connected in 1969. The Agreement concerning maximum flow was exceeded by London and discussions on a revision will be commenced in 1970.

Lake Erie Water Supply System

The project serves the City of St. Thomas and the Ford of Canada Automobile Assembly Plant at Talbotville. The old St. Thomas treatment and pumping plant was taken over in September 1969 and the Kettle Creek raw water supply was supplemented through a connection to the Lake Erie pipeline. The construction of a new treatment plant near Port Stanley was started and completion is scheduled for May, 1971.

The above projects are supervised by an Engineer-Manager located at the OWRC Regional Office, London.

SOUTH PEEL COUNTY WATER AND SEWAGE SYSTEM

The South Peel County Water and Sewage System began operation in June 1969. This system amalgamated all existing municipal and Commission treatment projects in the southern half of Peel County under ownership of and operation by the Province.

Future planning for enlargement and the actual operation of the project are the responsibility of an Engineer-Manager located in Toronto.

REGIONAL OPERATIONS

Region I

Forty projects were in operation in Region I during 1969. Five were water treatment plants and 12 were water pollution control plants. The balance of the projects were water distribution systems or sewage collection systems.

Construction continued on the Wallaceburg water pollution control plant. Plans were completed and the contract was let for the expansion of the Union Water System.

Tube settlers were used to double the capacity of the existing Dresden water plant, and plans were at various stages of development for the expansion of the Belle River water plant, the Waterford lagoon system, the Simcoe water pollution control plant, the Tillsonburg water pollution control plant, the Petrolia lagoon system, the Essex lagoon system and the Harrow water system. Plans for the Detroit River water works system were also well advanced.

In addition to the above, a further 39 new Provincial projects were at various stages of development.

Region II

Forty-eight projects were in operation during 1969. Fourteen of these were treatment facilities and the remainder were distribution or collection facilities.

Construction in connection with the enlargement of the Burlington Skyway plant proceeded. Reports were received on the expansion of three other facilities, and arrangements were made for the renovation of the Port Colborne East Side plant. A major change in sludge disposal methods was carried out at Brantford.

Eighteen projects were at various stages of development under Provincial ownership.

Region III

The 48 projects in operation in 1969 consisted of 20 treatment facilities and 28 distribution or collection systems.

A portion of the Arthur provincial works scheme was completed and placed in operation in December 1969.

Sludge lagoons constructed at the Kitchener water pollution control plant site will substantially reduce the sludge removal cost.

The facilities at the Georgetown, Fergus, Preston, Listowel, Galt and Arthur projects are being expanded.

Region IV

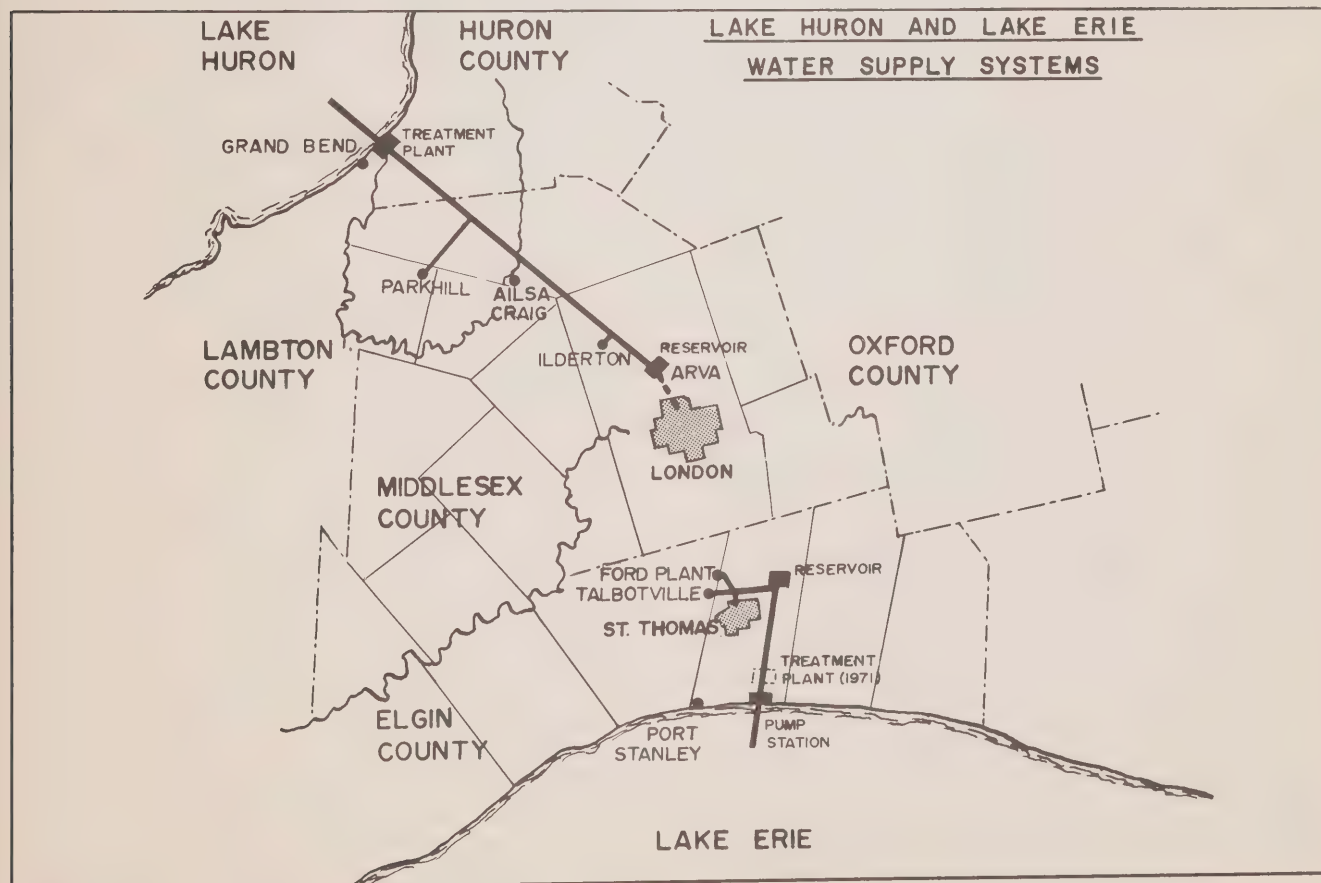
With the introduction of the South Peel water and sewage schemes, the number of projects within the revised Region IV dropped from 88 to 75 in 1969. Of these, 26 are water and sewage treatment facilities, 11 are deepwells (some with distribution systems), and the remaining 38 projects are enlargements to existing systems or distribution-collection systems.

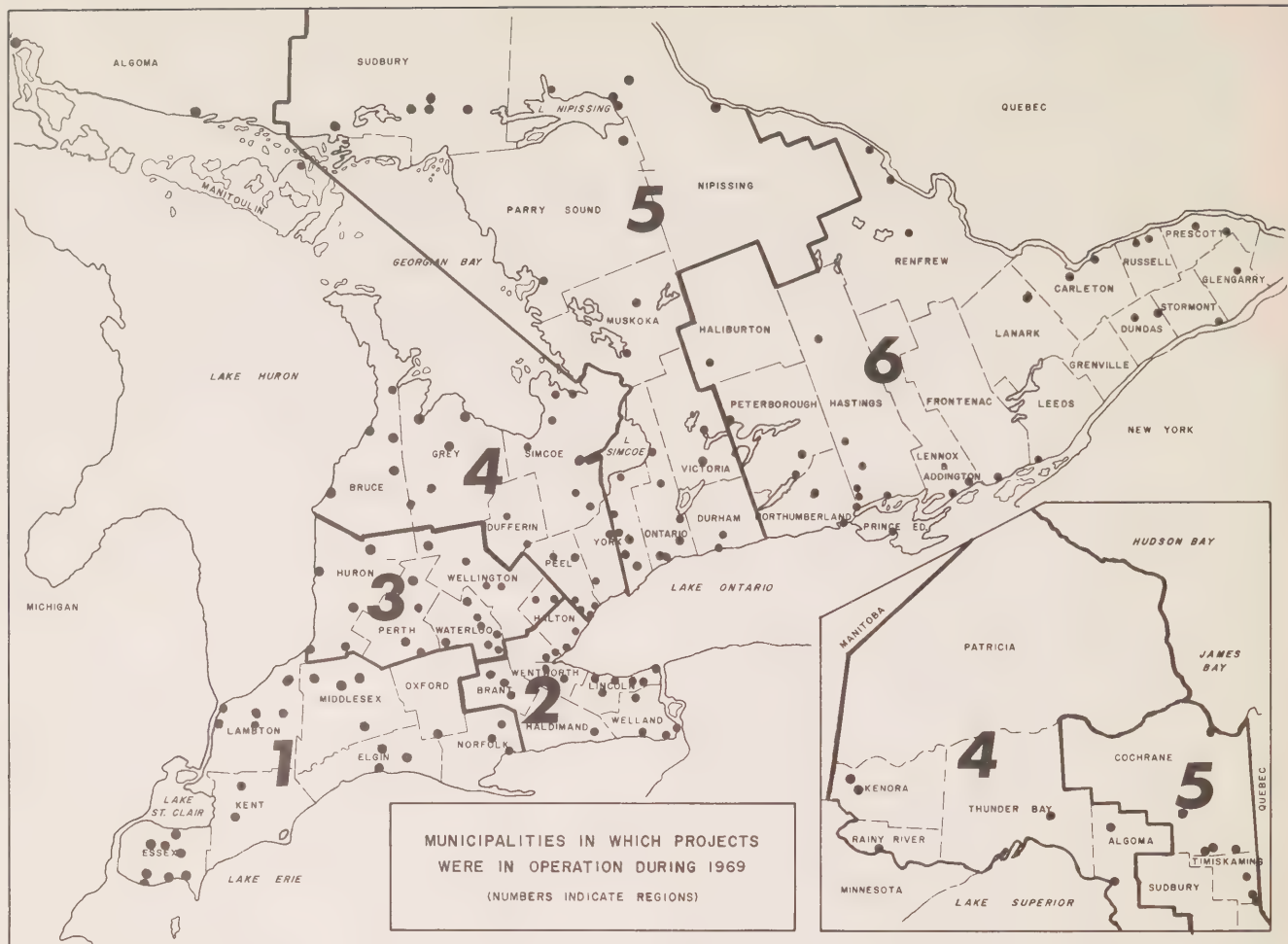
Provincial water and sewage systems became operational at Red Lake and Woodbridge.

Region V

There were 41 sewage and 31 water projects in operation in 1969.

Regular supervision was provided on a full-time basis at





13 sewage projects and five water projects, and on a part-time basis at 14 sewage projects and 14 water projects. The remaining projects were either extensions to existing facilities, or merely watermains or sewers.

Sewage treatment was provided by nine secondary treatment plants, three primary treatment plants and 12 waste stabilization ponds. Water was supplied to eight municipalities by wells, with no treatment other than chlorination where necessary, and to three municipalities by wells with iron treatment facilities. Surface water treated by filtration was supplied to four municipalities, and surface water with chlorination only was supplied to two municipalities.

Two new Provincial sewage projects in Pickering and Beaverton were put into operation, as were extensions to existing sewage projects in Markham and Mattawa.

Engineering reports were completed for the expansion of the sewage treatment facilities in North Bay and the Township of Neelon and Garson, and the water treatment facilities in Fenelon Falls.

Region VI

In 1969, 50 water and sewage treatment facilities were in operation. The projects consisted of 18 small water

treatment plants, eight waste stabilization ponds, four primary treatment plants, three activated sludge sewage treatment plants, and one trickling filter treatment plant.

The Township of Cumberland treatment plant was put into operation in October, 1969. This facility consisted of a 0.8 mgd primary treatment plant and a 24-inch trunk sewer.

Construction of the Campbellford sewage treatment plant and associated pumping stations was started in August, as was the enlargement of the Township of Ernestown waste stabilization pond and collection system.

Final construction drawings are being completed for the enlargement of the Belleville treatment plant, and for the construction of the Carleton Place, Eganville and Prescott sewage treatment plants. Tenders are to be called for the works in Belleville and Eganville early in 1970.

Financial proposals were submitted to 13 municipalities for initiating a provincially-owned project. Only one project was for the enlargement of an existing works; the others were for municipalities acquiring these services for the first time.

Thirteen engineering reports were reviewed in the Region. Four of the reports were for the enlargement of existing facilities, and nine for municipalities where services were not previously available.

Division of Project Development

P. G. Cockburn, Director
L. F. Pitura, Assistant Director

The Division of Project Development is responsible for the development of OWRC-financed water and sewage works schemes for municipalities under Sections 16a, 16(1) (d) and 39 of the OWRC Act. The activities of the Division are co-ordinated by the Administration Branch. Details concerning the duties and the work carried out by the other two branches in the Division, Projects Branch and Property Branch, are presented later in the report.

During the year there were several significant items that affected the functions of the Division and the highlights of these special activities are summarized below:

a. Assistance to Small Municipalities

The announcement by the Government of Ontario of a system of financial assistance to small municipalities (referred to earlier in this Report) resulted in an acceleration in the development of numerous programs which had been delayed because of extremely high costs of servicing. It is anticipated that the full effect of this new program will be realized in approximately two years and that its main influence will be on those municipalities below 5,000 in population.

With reference to the 15% subsidy applicable to area programs there are several schemes which are currently in various stages of development that will be affected by this arrangement and this should accelerate the entire process of development.

b. Agreement with City of Hamilton

Towards the latter part of the year, the City requested the OWRC to assume the responsibility for financing and constructing secondary sewage treatment facilities because of the extensive increase in costs. As a result, negotiations had reached a satisfactory state by the end of the year for the construction of the \$22.5 million project and it is anticipated that construction will commence early in 1970.

c. Agreement with City of St. Thomas

As a result of negotiations between representatives of the City and the OWRC, and particularly between the Mayor and the Chairman, an agreement was executed during the year in which the City agreed to purchase water from the OWRC Lake Erie Water Supply System.

d. Lambton County Area

The first hearing under Section 46a of the OWRC Act was held in Lambton County to hear presentations on the possibility of declaring a public water service area. An Order under this Section was subsequently issued by the OWRC and at the end of the year consulting engineers were retained to confirm the components of the system and

review the costing for eventual presentations to the municipalities in mid-1970.

e. Acquisition of Property

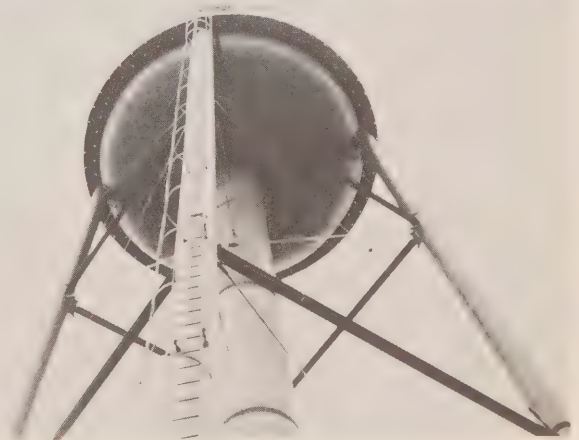
The full effect of the revised procedures for expropriation of lands required by the OWRC for the construction of sewage and water works was experienced during the year. The new procedures have necessitated extensive negotiations with respect to several construction contracts. The procedures for acquiring property have been reviewed in an attempt to minimize the effect of invoking the new procedures for expropriation.

f. Central Mortgage & Housing Corporation Loans for Sewage Works

Near the end of the year the CMHC indicated the procedures relating to loans for sewage works to be constructed in 1970 would be changed because of financial limitations. No details of the procedures were available but it is anticipated that there may be a shortage of federal funds for sewage works projects in the coming year.

PROJECTS BRANCH

The development of (a) OWRC/Municipal sewage and water projects, and (b) Provincially-owned sewage and water programs is the responsibility of this Branch. The number of OWRC/Municipal projects increased somewhat over 1968. However, Provincial programs at all stages have levelled off after the initial influx of applications immediately following the introduction of this type of program. Several Provincial programs are now in operation. Statistics and details pertaining to each type of project follow:



(a) *OWRC/Municipal Projects*

In 1969, 17 water projects at a total estimated cost of \$4,577,230 and 19 sewage projects at a cost estimated to be \$8,513,380 were accepted as projects by the Commission. A tabulated summary of the development of municipal projects follows:

	New Projects Requested	New Projects Accepted	Preliminary Agreements Executed	Final Agreements Executed	Rating Proposals Prepared	Financial Statements Prepared	OMB Notices Prepared	Hearings
1969								
January	3	3	4	2	1	1	4	—
February	4	3	1	2	1	2	—	—
March	1	1	1	1	2	1	—	—
April	2	2	—	2	2	2	2	—
May	6	2	1	1	2	1	1	—
June	3	3	1	—	1	—	1	1
July	3	4	—	1	4	1	2	2
August	3	4	2	2	3	1	1	—
September	3	3	3	1	2	3	4	—
October	9	3	2	1	1	1	1	1
November	4	5	6	2	—	1	1	—
December	2	3	1	2	2	1	1	—
Totals								
1969	43	36	22	17	21	15	18	4
1968	36	21	15	37	20	29	21	5
1967	27	31	23	22	33	30	25	12
1966	29	26	28	30	32	27	24	9
1965	35	33	31	35	34	27	26	15

Construction costs remained high. However, tender prices were generally more favourable in comparison with those of 1968, and, in a few instances, were below the preliminary estimates.

(b) *Provincial Programs*

There was a net increase of 29 programs accepted by the Commission during 1969, for a grand total of 262. Approximately 65 per cent of the overall total is for sewage works.

A tabulation of pertinent statistics related to Provincial programs follows:

	Statistics — Provincial Programs			Cumulative Total
	1969	1968	1967	
Applications Received for Sewage Works	31	37	65	221
Applications Received for Water Works	14	23	26	92
Provincial Programs Accepted by Commission	29	46	86	262
Engineering Agreements Executed for Retaining Consulting Engineers (Design Report)	26	55	40	191
Municipalities Participating in the Provincial Programs (Excluding those Municipalities Involved in Regional Studies)	31	32	70	242
Reports Received from Consulting Engineers (Draft, Preliminary, Final Design)	43	47	73	227
Tentative Rates Approved by Commission	52	68	51	208
Agreements for Final Design Executed	15	17	12	46

Included in the Provincial programs are a number of area programs which will provide services for more than one municipality. A brief report on each area program follows:

*Amherstburg-Anderdon-Malden Area
(Detroit River Water Works System)*

The agreements for the supply of water were executed in 1968. The construction of the elevated water tank is nearing completion and it is anticipated that the water-mains will be installed during February, 1970. Preparations are underway to call tenders for the water treatment plant. A study has been undertaken by staff regarding the possibility of arranging for an interim increased supply of water for the Town of Amherstburg.

Bleazard Valley Water Supply System

The Ontario Municipal Board issued its approval of an extensive water scheme to serve the townships of Valley East, Rayside and Balfour in the Sudbury area. It is anticipated that the agreements between the participating municipalities and the Commission will be executed early in 1970. Due to the complexity of the engineering assignments, construction may not be possible until late 1970 or early 1971.

Southern Kent County Area Water Supply System

The Ontario Municipal Board approved of an agreement with the City of Chatham for the construction of a raw water supply line from Lake Erie to that City. It is anticipated that the final design will begin early in 1970. The City is proceeding with the water treatment plant design.

Kingston Area Water Supply System

The municipalities involved in this area have yet to indicate their approval or rejection of the Commission's proposal presented late in 1968 for an area water supply system. Several meetings were held with municipal representatives at which time several questions were resolved. A further meeting is scheduled for early in 1970.

Lake Timiskaming Water Supply System

The agreements for the supply of water to the municipalities of Haileybury and Bucke were executed in 1968. Tenders for (a) a reservoir, (b) a secondary water supply system to serve North Cobalt, (c) a water distribution system in North Cobalt and the Township of Bucke and (d) a sewage works system to serve North Cobalt, were opened October 7, 1969. Construction is expected to begin in the spring of 1970 as soon as the weather permits.

Lambton County Water Supply System

A public hearing under Section 46a of the Act was held in February in connection with an area water supply. Subsequently, an "Area of Public Water Service" was formally designated. The Commission authorized the preparation of a design report concerning the water supply requirements of the area, and this report is expected to be completed by the end of April, 1970.

Lincoln County Area Sewage Works System

The original application for the area sewage works system was submitted to the Ontario Municipal Board in November, 1968. Early in 1969 revised rates were submitted to the municipalities and a revised proposal was forwarded to the OMB in July. The Board subsequently requested further information and in November directed that all the proposed works be advertised.

Southern Peel County Area Sewage and Water Works Systems

Several contracts involved in this major scheme have been completed, others are under construction and tenders are being called for still more. Negotiations are continuing with regard to the acquisition and future operation by the Commission of existing works, as well as property acquisitions.

Central York County Area Water and Sewage Works Systems

This area study remained relatively static during the latter part of the year pending the working out of a revised financial analysis, reflecting the 15 per cent write-off by the Province of the total capital costs, in connection with the plan of Provincial assistance. This was finally completed and a meeting was held with the participants in October. The Townships of Vaughan and Markham and Town of Markham subsequently expressed approval in principle of the Commission proposal, and the Town of Richmond Hill is expected to forward its decision early in 1970.

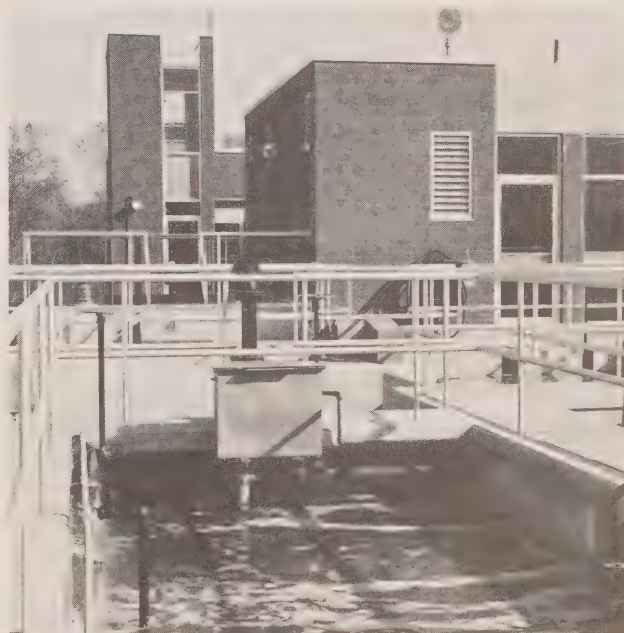
PROPERTY BRANCH

	Statistics		
Properties	1967	1968	1969
Properties under negotiation at end of previous year	35	37	70
New properties listed for acquisition during previous year	257	155	188
Options obtained or otherwise acquired	255	122	175
Properties under negotiation at end of year	37	70	83
Options			
Options held at end of previous year	168	115	148
New options acquired during year	124	122	175
Transactions completed during year	177	89	52
Options outstanding at end of year	155	148	271

In 1969 the number of property acquisitions was larger than in 1968. The predominance of Provincial programs, together with the emergence of some programs on a regional basis, tends to extend the timing applicable to land acquisition.

It is noted that more option agreements were purchased than in either 1967 or 1968, although fewer have been exercised.

Standards of procedure are constantly under study. It has been considered, for example, that due to recent experience, option agreement forms should provide for a longer period than heretofore, in order to minimize the possible necessity of going back to the owner for an extension or renewal. The matter of contacting affected owners of land at the most strategic time deserves serious thought in order to avoid possible "shot-gun" demands for acquisitions.



Pickering water pollution control plant

Division of Research

A. J. Harris, Director

The Division of Research, since its inception, has been studying methods of improving wastewater treatment systems, with a view to making existing treatment more effective and to provide relatively inexpensive but effective nutrient removal facilities. The Division is composed of three branches — the Applied Sciences Branch, the Technical Advisory Services Branch and the Special Studies Branch.

The efficiency of existing installations, including tertiary lagoons and effluent filters, was examined by the Applied Sciences Branch and research facilities were established at Brampton to test such processes under controlled conditions.

Supplementing these investigations was a chemical treatment study. The first phase of the study, initiated in December 1964 and extending into April of 1965, comprised a comprehensive series of jar tests for the removal of phosphate nutrients. During the experimental addition of coagulant chemicals, such as alum, ferric chloride, lime, and acid-activated fly ash, the removal of phosphates and related nutrients from samples of the plant effluent was observed. Calculations based on more than 180 laboratory and 150 field test trials were used to estimate chemical cost curves for phosphate removal using such coagulants. The jar tests also indicated that significant improvements in effluent biochemical oxygen demand (BOD) could be realized with even minimum coagulant dosages.

These investigations prompted further studies of chemical treatment methods, which, after extensive model scale studies in the Research laboratory, led to the establishment of a pilot plant at Richmond Hill in the spring of 1969. The results of this investigation have been indicated by the Applied Science Branch later in this Report.

Further work is now being carried out to extend this study into a full-scale nutrient removal plant to be established at an existing OWRC-owned waste treatment facility.

The major functions of the Technical Advisory Services Branch have remained unchanged from that of the previous year; that is, the analysis of existing treatment processes and the assessment of various types of systems for the treatment of either potable water or wastewaters.

Of particular interest was the development by the Technical Advisory Services Branch of the use of silica for controlling red water problems in well water supplies. During an investigation into iron leakage from iron removal filters, it was noted that the leakage was related to the presence and quantity of silica in the raw water. Subsequent laboratory scale studies confirmed that N brand sodium silicate, when added to prechlorinated iron bearing water would effectively prevent the agglomeration and precipitation of the iron.

The process for controlling iron instability in treated water is exceptionally simple. Ordinary "N" sodium silicate

is added to the water near the point of chlorination. The Town of Markham water supply is a good example. Into this well water supply, with 0.5 ppm iron as Fe, 150 ppm hardness as CaCO_3 , a pH of 7.6 to 8.0 and a natural silica content of 20 ppm is fed an additional 3 ppm silica direct from drums of 41⁰ Be "N" sodium silicate. The addition is at the well head just inches from the point of chlorination. Minimum silica requirement appears to be about 2.7 ppm SiO_2 so that actual addition more than controls all iron problems. Feeders with steel ball check valves are used to handle the syrupy silicate solution.

Laboratory tests suggest that the silica requirement varies, not only with the excess iron content, but also with pH and hardness. High (above 7.5) pH's are more favourable, as are also low hardnesses. Dosage requirements are still open to exact definition where taste so far has proved to be the surest indication of balanced dosage. Over-dosage is associated with the characteristic sweet taste of diluted silicate, whereas under-dosage retains the water's iron flavour and iron-staining properties. Application of the silicate should be within 15 seconds prior to or following chlorination.

Quite a number of Ontario communities appear to be having successful trials with silicate. Publication of the Division's findings will be presented at the annual conference of the American Water Works Association in the coming year.

There is continuing concern regarding the possible presence of pathogenic and other objectionable viruses in water supplies and, at present, there is no reliable and simple method for routine monitoring of viruses. A modification of a method for enumerating bacterial viruses in water was developed by the Special Studies Branch, and used to test water samples of various types on an experimental scale. A report on its possible application to the monitoring of water supplies was prepared (Research Publication No. 26). The counting method has also been applied in experiments to determine the efficiency of soluble (sodium alginate) filters in the recovery of low numbers of such viruses from water. After extensive testing with a bacteriophage as a test virus, a laboratory-made soluble alginate filter unit appeared to be capable of detecting 5-10 virus particles per litre of water. A commercial filter unit was acquired and its performance with volumes of water up to 4 litres is still under study. Preliminary experiments utilizing the electron microscope to identify viruses isolated with the alginate filters were undertaken in cooperation with the University of Toronto.

The Special Studies Branch is continuing its studies of detergents and the effects of their components on the aquatic environment. Investigations also continue into the effects of phosphorus as compared to possible phosphorus substitutes.

The availability of trisodium nitrilotriacetic acid (NTA Na_3) as a nutrient for algae was tested using axenic cultures

of *Chlorella pyrenoidosa* grown in a mineral media where NTA Na₃ was the only nitrogen source and in the supernatant of acclimatized activated sludge to which concentrations of NTA Na₃ up to 275 mg/l had been added. In the former experiment, NTA Na₃ at a concentration of 10 mg of nitrogen per litre promoted more algal growth after seven days than an equivalent quantity of nitrate nitrogen.

A more detailed account of the activities of the three branches of the Division follows.

APPLIED SCIENCES BRANCH

The Applied Sciences Branch is an engineering group which carries out evaluations of existing processes, investigates processes and theories proposed for use, and undertakes development work on methods of water pollution control and abatement for use throughout Ontario. The studies are usually of a long-term nature extending over a period of 1-1/2 to 2 years.

The following brief descriptions of the major work carried out by the Branch illustrate the scope and nature of the studies.

Chemical Treatment of Domestic Sewage

Following successful laboratory scale studies into the chemical treatment of domestic sewage for phosphorus removal, a pilot scale study of the process was carried out at the Richmond Hill WPCP followed by a later study at the Sault Ste. Marie WPCP. The Richmond Hill study indicated that the chemical treatment of raw sewage in the primary clarifier could be incorporated into an existing conventional activated sludge plant with a view to effecting high removals of phosphorus as well as increasing the efficiency of the plant in respect to BOD and suspended solids (SS) removals. The Sault Ste. Marie study indicated that the addition of chemical to the primary clarifier of a primary treatment plant could effectively remove high levels of phosphorus and substantially increase BOD and SS removals.

A 10,000 gpd trailer-mounted pilot chemical treatment plant has been constructed and will be used for additional waste treatment studies.

Lake Eutrophication

In conjunction with the laboratory-scale chemical sewage treatment studies, a laboratory investigation was carried out to evaluate the effects of various nutrient removal processes on eutrophication properties of domestic sewage entering small soft-water lakes typical of the Muskoka area.

This study indicated that chemical treatment inhibited the algal growth potential of raw sewage under controlled conditions of light and temperature, whereas filtered activated sludge effluent greatly stimulated algal growth.

Farm Animal Waste Management

The Applied Sciences Branch was involved in a number of activities with reference to the problem of farm animal waste.

These include:

- (a) participation in conferences, technical seminars and expositions;
- (b) representation on the University of Guelph Animal Waste Utilization Committee;
- (c) giving advice and guidance to the agricultural industry, other governmental agencies and individuals;
- (d) keeping up-to-date with developments and research throughout the world on the farm animal waste management problem. The Branch continued to cooperate with other agencies in the applied research being carried out in this field.

Effluent Polishing Process Evaluation

A cooperative field appraisal was carried out by this Branch and the manufacturer on a continuous flow effluent polishing filter at an OWRC-operated sewage treatment plant. Although this was the only field investigation of an effluent polishing process which was undertaken, an effort is being made to keep abreast of all the latest developments in this regard.

Ultraviolet Disinfection

An evaluation study, initiated during the previous year on the applicability of ultraviolet irradiation for the purification of potable water supplies, was completed. This involved rigorous tests on a UV water purifier sold commercially for household applications. The results of these tests were presented in a report, along with a literature review on the status of ultraviolet methods of water disinfection.

Chemical Oil Dispersants

Work was continued in compiling data and evaluating various chemicals and materials which are commercially available for cleaning up oil pollution in water when accidental oil spills have occurred.

A paper dealing with the evaluation in the laboratory of chemical oil dispersing agents was presented at a conference on oil spills.

During the year, staff assisted in the clean-up of two small oil spills. One of these resulted from a highway accident involving a tank truck carrying fuel oil and the other was a leakage from a community fuel oil distribution system, resulting in the contamination of a public swimming beach.

Treatment of Wastes from Uranium Milling Plants

A joint study was carried out with the Bacteriology Branch, Division of Laboratories, to determine causes of, and methods of dealing with, the problems of acid conditions occurring in the tailings ponds receiving treated waste discharges from uranium mines at Elliot Lake. The study involved extensive laboratory and pilot tests to find suitable corrective methods of further treatment in order to reduce levels of chemical contaminants in the wastes effluents derived from the uranium refining process. Most of the

laboratory work has been completed and a report is being prepared.

Gamma Irradiation of Sewage and Sewage Sludges

Work continued in 1969 on the investigation of the effects of gamma irradiation on artificial and natural wastewaters and on sewage sludges.

Experiments with corn starch solutions confirmed the results of earlier work wherein no improvement in settling took place, but degradation of the starch molecules occurred at high doses. Gamma irradiation of raw sewage did not consistently lead to improved settling but some form of degradation occurred at high doses. Waste activated sludges showed significant improvements in settling characteristics after irradiation.

In order to facilitate a wider range of experiments, the irradiation units were returned to Atomic Energy of Canada Limited for reloading. The units will again be placed in service early in 1970.

Cladophora

Investigations were carried out during 1969 to determine the extent of *Cladophora* growth in Lake Ontario and Lake Erie. The Division continued to observe growth beds in these lakes in order to obtain information on the distribution and degree of growth of *Cladophora*.

A study was initiated to determine if a correlation exists between certain meteorological and limnological conditions and the development of nuisance growths of algae.

Enhanced Biological Removal of Phosphorus

A study, begun in 1967, into possible modifications to the activated sludge process to achieve high reductions in phosphorus within the treatment plant was continued in 1969. A nutrient monitoring program was initiated to compare phosphorus removal effectiveness through various types of activated sludge plants operating under normal conditions and to observe what parameters of effective treatment may be correlated with enhanced phosphorus removal. Once this aspect has been determined, several modifications to conventional plant operation will be tried in order that improved phosphorus removal may be attained.

Frazil Ice

A study of the occurrence and prevention of the formation of frazil ice in surface water intakes was continued in 1969. The data being obtained from a survey of experiences at water plants in Ontario will be used to aid authorities in Ontario in the action to be taken to alleviate ice blockage problems and will also facilitate the review of the design of new intakes.

Removal of Hydrogen Sulphide from Ground Waters

A report was prepared early in 1969 reviewing the problems of removing hydrogen sulphide from small well-water supplies. The Report presents several methods that would reduce or eliminate tastes and odours caused by even low sulphide concentrations.

Based on a literature survey, it is concluded that aeration alone, or a combination of pH reduction and aeration, can reduce the concentration of sulphide to below 2 ppm. However, if it is desirable to reduce the sulphides to zero, oxidation with chlorine or potassium permanganate is required.

Removal of Anionic Detergents by Municipal Treatment Plants

The full-scale introduction of biodegradable anionic detergent to the Canadian consumer market was completed by April, 1967. A study was initiated to observe the effect of the conversion from "hard" alkyl benzene sulphonate (ABS) surfactants to the more readily biodegradable "soft" linear alkylate sulphonate (LAS) compounds on the quality of effluent from wastewater treatment plants.

Aerobic Digestion

A study of the aerobic digestion process begun in 1968 was completed in 1969. The results of this study indicate:

- (a) the detention times being used in the design of aerobic digesters are generally inadequate, particularly for winter operation under Ontario climatic conditions, and should be sufficiently increased so that the required amount of stabilization for safe disposal will take place during cold weather operation; and
- (b) the air supply being used in the design of these units is insufficient to maintain aerobic conditions of maximum uptake rates which occur during warm weather and should be increased significantly.

This study has demonstrated that a properly designed and operated aerobic digestion process is capable of producing a stable sludge with low oxygen demand, good dewatering characteristics and no offensive odours. A report presenting the results of these studies is being prepared.

TECHNICAL ADVISORY SERVICES BRANCH

As in the past, most of the work of the Technical Advisory Services Branch was carried out in cooperation with the divisions of Sanitary Engineering, Plant Operations and Industrial Wastes. These activities are summarized in the following sections:

Water Purification Section

As in 1968, the emphasis in 1969 was on coagulation and filter performance. It was demonstrated that coagulant aids such as activated silica and polyelectrolytes, could be used to improve sedimentation, increase filter run time and raise the quality of the final effluent. In most instances, bench-scale tests are used to establish the best treatment program and these are then tried on a plant scale, accompanied by operator training in such things as the operating technique and the laboratory analyses necessary to properly control the process.

In the case of the Dresden water purification plant, efficient chemical treatment combined with tube settlers enabled the plant output to be tripled, thus overcoming what would have been a severe summer water shortage.

Ground waters containing excessive amounts of iron were again a common problem area; however, a successful threshold treatment technique was developed which supplants polyphosphate feeding. The effectiveness of polyphosphate in preventing iron staining has been rather unpredictable. Supplementing the natural silica content by adding small amounts of sodium silicate effectively prevents iron staining and red water conditions. This material is cheaper and permits greater flexibility of operation than polyphosphates, particularly on wells which are chlorinated. This method is now being used at a number of municipalities in the treatment of waters with as much as 0.7 ppm iron and the results are being assessed by this Branch.

A number of gas evolution problems were again encountered, the most notable being a well in Turkey Point Provincial Park in which the gas content analyzed 76 per cent methane. Design proposals for a suitable gas removal system were prepared and submitted to the Parks Branch since apparently no supplier could meet its requirements.

Another unique problem successfully overcome this year was the development of a practical nitrate-removal system for a new well supplying the Village of Barry's Bay.

Pilot study work continued on the use of the many oxidants available for taste and odour control and further work is planned — particularly on the application of hydrogen peroxide, both alone and in conjunction with other common oxidants.

Work was begun on the development of a simple method of simultaneously cleaning and disinfecting watermains, using chlorination in conjunction with foam swabbing.

Treatability studies for proposed water supplies were an important part of the Branch's work. From these studies, detailed recommendations for plant design are prepared by the Branch.

Wastewater Section

As in previous years, considerable technical assistance was provided to both the Division of Sanitary Engineering and the Division of Plant Operations in dealing with operating problems at municipal wastewater treatment plants. In fact, it constituted the largest single work load. In addition, the evaluation of existing and proposed treatment equipment and processes was carried out.

The most obvious change in the work load of this section has been the conspicuous trend toward employing chemical and physical methods for treatment of industrial wastewaters.

At the request of the Division of Plant Operations, a field evaluation of the turbine aerators installed at the Waterloo water pollution control plant was conducted. As a result of poor performance, primarily due to hydraulic overload at this same plant, field studies with a pilot scale tube settler installed in the secondary clarifier were carried out. These tests yielded good clarification at hydraulic

loadings of up to 2,900 gpd/sq. ft. From these tests, it was concluded that tube settlers could be used to expand the capacity of existing secondary clarifiers.

Also, at the request of the Division of Plant Operations, an evaluation of presently available polyelectrolytes for application in primary treatment of raw sewage is being undertaken. Previous work in this area has been carried out on a trial and error basis with mixed success. The applicability of zeta-potential measurements in this area is also being studied.

In conjunction with the Division of Sanitary Engineering, a full scale study involving chemical treatment at the Kemptville water pollution control plant was conducted. Laboratory jar tests indicated the feasibility of the full scale testing involving high dosage alum addition. The high quality effluent, usually obtained during the study, deteriorated considerably when wastes from a local creamery were discharged.

An on-site pilot scale biological sewage treatment study was conducted at Kapuskasing. This study, requested by the Division of Sanitary Engineering, indicated that a high quality effluent could be obtained using the activated sludge process with six hours aeration time and no primary clarification.

An extensive field investigation into the performance of aerobic digesters located in the Province was completed. This study indicated that present design criteria for air supply and liquid detention time are grossly inadequate for the Ontario environment. These findings are being taken into account in considering aerobic digestion as part of future treatment facilities.



Lake bottom sampling

As a result of the successful demonstration of lime addition to raw sewage in the removal of phosphorus, considerable discussion as to the disposal of lime sludge has ensued. Consequently, a laboratory study involving anaerobic digestion of both raw and lime sludge was undertaken. Model digesters, with mixing and gas collection, are being operated at conventional loading rates. Physical characteristics of both sludges are also being determined.

Primarily at the request of the Division of Industrial Wastes, many laboratory studies involving biodegradability and/or treatability of specific wastewaters were carried out. This type of work serves to assist industries in considering various treatment methods for pretreating their wastes and also aids municipalities in assessing the effects of particular industrial wastes proposed for discharge to sewerage systems.

The process feasibility of joint treatment facilities is also investigated when requested either by the Division of Sanitary Engineering or the Division of Industrial Wastes.

Over the past several years, the volume of this work has been increasing steadily. As a result, extensive bench-scale facilities for studies involving both activated sludge and chemical treatment processes have been established.

Laboratory Section

A Total Oxygen Demand (TOD) Analyzer was received on a rental-purchase arrangement. Correspondence with other users and four months of evaluation indicate that this instrument is considerably more reliable than some of the total organic carbon analyzers currently available. The significant feature of such an instrument is that it allows the immediate assessment of the performance of various biological treatment systems being studied, both in the laboratory and in the field.

During the year, a laboratory evaluation of the various methods of determining chlorine residuals was completed and distributed to the other divisions.

The laboratory section has continued to maintain not only the branch instruments, but also some belonging to the divisions of Industrial Wastes and Water Resources.

This same section constructed several electronic units for divisional use. These include a precision millivolt power supply for checking pH meters as well as some operational amplifiers to adapt recorders to monitoring units.

SPECIAL STUDIES BRANCH

Trisodium Nitrilotriacetate and Algae

The relationships between trisodium nitrilotriacetate, a potential detergent builder, and a representative alga, *Chlorella pyrenoidosa*, were investigated with respect to toxicity and as a source of nitrogen for algal growth both before and after treatment of the material in an acclimatized activated sludge system. The compound was found to be non-toxic to *Chlorella* at concentrations up to 275 mg/l and could act as a source of nitrogen for algal growth when fed directly or after treatment in an activated sludge system.

Effects of Acid Mine Wastes on Phytoplankton

The report on the effects of acid wastes from uranium milling operations on phytoplankton production and community composition was completed. The low pH in contaminated lakes was shown to contribute to low inorganic carbon concentrations which severely curtailed primary productivity. The ramifications will include lesser production of fish populations and delay in removal of radionuclides by phytoplankton uptake and sedimentation to the bottom muds.

In-vitro Responses of Soft Water Algae to Fertilizations

Utilizing a technique described in OWRC Research Publication No. 35, and to further clarify a relationship reported in OWRC Research Publication No. 32, the effects of carbon, nitrogen and/or phosphorus on the growth of algae contained in a sample of surface water obtained from an oligotrophic, soft water lake were investigated, using in-vitro cultures at the laboratory. Enrichment with any one substance did not stimulate algal growth. In those cultures receiving both nitrate and phosphate, but not carbon, the alkalinity was found to have risen during the study. The results of the study indicate that clarification of the role of carbon as a limiting nutrient in soft water lakes must therefore be examined by eliminating any induced increase in alkalinity resulting from fertilization with salts of nitrogen and phosphorus.

In-Vitro Nutrient Bioassay Investigations with Lake Muskoka Algal Populations

Based on the technique described in OWRC Research Publication No. 35, laboratory experiments into nutrient-phytoplankton relationships in raw water samples of Lake Muskoka were carried out. Interim results indicate that additions of phosphorus and carbon, but not nitrogen, are stimulatory for algal development.

Eutrophication of Soft-water Lakes

In May, a field laboratory was set up in the vicinity of several small lakes fifteen miles southeast of Elliot Lake and sampling begun in early June. Algal production and nutrient levels were measured.

Sufficient background data have been collected to allow treatment of lakes in early 1970 with wastes simulating four domestic waste processes (representing various approaches to nutrient removal) to determine the best practical treatment of wastewater for ultimate disposal to soft-water lakes.

Laboratory studies on analysis of low concentrations of inorganic carbon for use in primary productivity studies were carried out.

Throughout the year, members of the staff worked in cooperation with the Biology Branch, Division of Laboratories, on this soft-water lake project as well as on the Muskoka Lakes program. The latter consisted of nutrient-budget development, measurement of productivity, studies on currents within the lakes and other limnological features of the three lakes — Muskoka, Rosseau and Joseph.

Nutrient-Phytoplankton Relationships in Lake-on-the-Mountain (Research Publication No. 35)

Nutrient-phytoplankton relationships of Lake-on-the-Mountain were investigated because this lake, although displaying an alkalinity comparable to various eutrophic Kawartha lakes (OWRC Research Publication No. 32, 1968), did not support similar levels of algae. In situ examinations in conjunction with laboratory nutrient experiments suggest that the algal standing crops were restricted because of decreasing availability of nitrogen and phosphorus. As the nutrient budget for this lake is established essentially at the time of the spring overturn, the results of the study provide an insight into concentrations of nitrogen and phosphorus established at that time which will not subsequently support excessive development of algae in a thermally stratified hard-water lake.

Nitrogen and Phosphorus Contents of Selected Phytoplankton Populations

Laboratory investigations to characterize relationships between various phytoplankton parameters (Chlorophyll a, ASU/m1, and carbon fixation) and the contents of the algae with respect to nitrogen and essential and total phosphorus, have been initiated utilizing raw water samples from lakes along the Trent system, mixed phytoplankton populations from Lake-on-the-Mountain and Lake Ontario cultured in vitro, and selected strains of algae. From these studies, it is hoped to establish levels for nitrogen and phosphorus in surface waters which will not support obnoxious levels of phytoplankton and yet not adversely affect the natural productive processes of these waters.

Phytoplankton Populations in Several Ice-covered Lakes of Southern Ontario

Although taste and odour problems related to algae have occurred during winter months, very little information is available concerning algal development in lakes at this time of year. The quantity and composition of the phytoplankton in lakes of various trophic levels was therefore investigated during and immediately following a period of ice-cover. Algal populations in all lakes, irrespective of their trophic status, were quite low, probably as a result of insufficient light penetration through the snow and ice cover as well as a lack of sufficient dissolved organics which can also support algal development. Following the loss of ice cover, algal populations in eutrophic lakes increased up to 250 times. The pertinence of these results to the development of taste and odours in water supplies during the winter is being considered.

Assessment and Treatment of Taste and Odours Associated with Algae

Experiments to develop methods for eradicating undesirable tastes and odours in water supplies originating from algal materials have been initiated. Results so far indicate for example that a bacterial-free culture of the alga *Anabaena*, can impart a "pigpen" odour to water. Further studies with this and several other suspected algal forms

with and without the presence of bacteria are planned.

Nutrient Removal – Effect on Receiving Streams

A preliminary survey was made of the East Don and Rouge rivers and the sewage treatment plants on them in the Thornhill and Markham Village areas, respectively. Following this, a cooperative project proposal was made to study the effect of anticipated nutrient removal from the sewage effluents from sewage treatment plants located on the two rivers.

More detailed surveys of the two rivers were made, note being taken of riffles, falls and pools, together with distances and flow rates. The instrumentation necessary for the proposed dissolved oxygen measurements in the stream involved the design and construction by Division of Research personnel of temperature stable, battery-operated amplifiers. These amplifiers transferred the signal from oxygen and temperature probes to D.C. dual trace recorders.

Measurements of dissolved oxygen in the Rouge River below the Markham sewage treatment plant indicated an oxygen sag and the instruments, five in all and in protective housing, were suitably positioned to record dissolved oxygen and temperature. Preliminary results indicate a substantial diurnal oxygen variation, most probably connected with the extensive plant life present at the time of measurement. The effect of plant growth should be an important factor in the development of oxygen concentration profile below sewage treatment plant effluents. More extensive measurements are planned for the summer of 1970.

Algal Productivity

A review was made of a method for determining photosynthetic activity, and consequent estimates of plant density and nutrient enrichment, from diurnal oxygen concentrations measured within bodies of water.

Mathematical Modelling of Stream Oxygen Levels

Analog simulation was reviewed as a means of testing proposed mathematical models of the oxygen profiles within streams. Models include the effects of tributaries on these streams with regard to flow and temperature, varying BOD inputs, reaeration and photosynthetic, respirational and benthic oxygen demands connected with oxygen concentrations in streams and rivers below sewage treatment plants. Biological data with regard to plant life density and respirational oxygen demands are necessary for the use of the model. Prediction of oxygen concentrations for a range of operating conditions should be possible using the detailed model.

Sludge Oxygen Demand

Measurements were made of the benthic oxygen demand of Ottawa River sludge for the Water Quality Surveys Branch.

Nutrient Budget for Bay of Quinte

A tentative mathematical model was formulated for the 51

prediction of nutrient levels in the Bay of Quinte. The model is based on the assumption that the channel is in plug flow. It is hoped to provide information with regard to the uptake and subsequent loss to the benthos of particular nutrients.

Data were assembled and an analysis of the nutrient budget of the Bay of Quinte was commenced. Components in the model include river inputs, municipal inputs, output from the Bay to Lake Ontario, sedimentation to bottom muds and use by phytoplankton.

Bottom Animal Communities — Bay of Quinte

Studies on benthic macroinvertebrate communities in relation to the state of eutrophication of the Bay of Quinte were concluded. The report was submitted to the School of Graduate Studies of the University of Toronto by a staff member in partial fulfillment of the requirements for the Ph.D. degree. Emphasis was placed on the limnology of the sediment-water interface, import of energy to the bottom muds, the use of this energy by the total benthic community and macroinvertebrates, and the relationships among macroinvertebrate production, diversity in the communities, import of detritus and temperature.

Virus Isolation

A continuous line of RK₁₃ tissue culture cells was set up and maintained in the laboratory throughout the year. Initially, toxicity problems were encountered in the preparation of the maintaining medium and modifications of both the medium constituents and the propagation technique were necessary. Pooled stocks of virus at different passage levels were produced, stabilized and stored. The titration procedure most suitable for the study was experimentally selected from the several available and the titres of the virus stocks were determined. Such virus preparations are used in both virus isolation and virus inactivation experiments.

Preliminary experiments to isolate viruses from potable water, employing a two-phase polymer system with sodium detran sulphate and polyethylene glycol, were carried out. Using a bacterial virus, some success was obtained with the method and further refinement may lead to recovery of low numbers of virus from relatively large volumes of water.

Virus Inactivation

The virus inactivating capacity of several forms of water treatment, including gamma irradiation and ozonation, was determined. The results of these initial experiments were compiled into a paper entitled "Virus Inactivation in Water Supplies" and presented at the 4th Canadian Symposium on Water Pollution Research.

Studies on the inactivation of viruses by ultraviolet irradiation, both under controlled laboratory conditions and with a commercial unit, were completed (Research Publication No. 2015).

Using a bacterial virus as an indicator of virus survival, the applications of gamma irradiation in the treatment of potable water was investigated. Experiments were carried out employing irradiation alone, or in combination with

low free chlorine residuals. The inactivation of the virus using sterilized sewage as the suspending medium was also recorded.

During the year, several reports of the results of these studies were presented at seminars at the request of the Commercial Products Division of Atomic Energy of Canada Limited. Inquiries concerning the radiation work were received from interested organizations both in Canada and the U.S.A.

Taste and Odour

The component responsible for the taste and odour caused by Actinomycetes was produced, using several different extraction methods in conjunction with different culture techniques to determine which produced the greatest quantity. Preliminary threshold odour determinations were carried out on solutions of the diluted component, both before and after treatment by conventional methods for odour removal; activated charcoal appeared to provide the best removal.

Actinomycete isolations were performed on field samples of lake water in an attempt to associate the development of tastes and odours with an increase in Actinomycete population. The normal recoverable Actinomycete population in surface waters would appear to be less than ten organisms per ml.



Nutrient removal studies

Division of Sanitary Engineering

J. R. Barr, Director

G. R. Trewin, Assistant Director

The program of the Division of Sanitary Engineering deals with the management of water in three categories: water quality, water supply, and pollution control. The program responsibilities are handled by five activity-related branches and two staff positions. The branch functions are: (a) the evaluation of plans of proposed water supply and wastewater treatment installations; (b) a field activity program including pollution surveys and pollution complaint review, sub-division review, and the promotion, inspection and supervision of water and wastewater treatment plants; (c) a water quality guidance program including basin studies, wastewater treatment evaluations as related to effect of inputs on receiving waters, and the surveillance and monitoring of water quality; (d) the supervision of plumbing and the control of pollution from watercraft; and (e) the planning of regional water supply and wastewater treatment facilities.

The two staff functions provide guidance to the Division's water supply and wastewater treatment programs.

An important function of the Commission is the holding of public hearings with respect to sewage works. When a municipality intends to install sewage works in another municipality, the Commission, as required under the OWRC Act, must hold a public hearing. In addition, the Commission may hold public hearings before approving sewage treatment works to be located within the municipality to be served or works which are to be privately-owned and operated. The purpose of the hearings is to ensure that the intended works will not adversely affect adjacent properties.

In 1969, 32 public hearings were held in municipalities regarding proposed sewage works. Twenty-four of the hearings involved Provincial projects under development by the OWRC.

Training Programs

The Division took an active part in the training activities of both the Canadian Section American Water Works Association and the Ontario Branch, Canadian Section AWWA. A number of education programs designed for water works personnel were developed. In this connection, two "high-level" seminars were jointly sponsored by the OWRC and the AWWA to broaden the knowledge of consulting engineers and senior water works personnel with respect to current topics. The two-day workshop series on the topic of "Coagulation-Flocculation-Sedimentation-Filtration" was continued during 1969 with sessions being held at the Toronto Westerly Filtration Plant and the Ottawa Britannia Filtration Plant. These workshops are designed for superintendents and senior water works operators. A new series of workshops on "Chlorination" was begun, and a two-day

meeting was held at the Welland Water Filtration Plant. The workshops are an extension of the water works operator courses being given each year at the OWRC Laboratory.

During the past year, the Sixth Intermediate and Senior Water Works Operator Courses were given, with 104 successful candidates receiving their certificates. This brings the total number of successful candidates completing the courses since 1960 to 455. To provide for the training of distribution system employees and operators involved strictly with the operation of deep wells, a new five-day course was held at the OWRC Laboratory, with some 64 persons in attendance. This new course was well received, and it is intended to develop it further and provide advanced courses in this subject area in future years.

The Sixth Senior Sewage Works Operators Course was held during June 9-13 and the Seventh Basic Course December 8-12. One hundred and five operators graduated from the Senior Course and 136 attended the Basic Course. This brings the total number of successful candidates completing the courses since 1960 to 516. Each year the number of requests from persons wishing to attend the course increases.

Technical papers were prepared and presented at ten conferences in Canada and the United States.

DESIGN APPROVALS BRANCH

The Branch appraises engineering reports, plans and specifications submitted for the approval of water works and sewage works in accordance with sections 30 and 31 of The OWRC Act.

Applications and Approvals

The Branch processed 2,241 applications and engineering reports during 1969. These resulted in a total of 2,209 certificates of approval being issued, representing a total estimated value of \$207.6 million. In 1968, 1,991 certificates were issued at a total estimated expenditure of \$202.7 million.

Certificates issued for water works applications totalled 943 and involved an estimated expenditure of \$54.7 million, compared with 831 certificates and an expenditure of \$52.5 million in 1968.

In the sewage works field, 1,266 certificates were issued during the year at an estimated cost of \$152.9 million, compared with 1,160 certificates in 1968 at an estimated cost of \$150.2 million.

Of the total number of certificates issued in 1969, 27 were for OWRC water works projects, and 34 were for OWRC sewage works projects. Estimated costs of the projects were \$2.1 million for sewage works and \$4.3 million for water works.

The Branch reviewed 97 conceptual briefs and design reports in conjunction with OWRC and Provincial projects.

Table 1 provides a breakdown of the total estimated value of works with respect to type of approval issued.

TABLE 1

SUMMARY OF WATER AND SEWAGE WORKS APPROVALS

WATER WORKS	Estimated Costs
Extensions to existing systems	\$ 45,130,885
Supply and purification	8,259,350
New systems	1,314,772
Total for Water Works	\$ 54,705,007
SEWAGE WORKS	
Extensions to existing systems	126,297,942
Treatment and disposal	25,326,906
New systems	1,274,554
Total for Sewage Works	\$152,899,402

Sewage Treatment Plant Approvals

Approvals were issued for the construction of 7 new municipal sewage treatment plants and for the extension of 11 existing plants. Table 3, indicates the municipalities for which these approvals were issued.

TABLE 3

MUNICIPAL WATER POLLUTION CONTROL PLANT APPROVALS ISSUED DURING 1969

Municipality	New Plant or Extension	Estimated Cost
Ajax	Extension	\$ 500,000
Barrie	Extension	405,732
Bucke Township*	New Plant	52,700
Caledonia	Extension	50,022
Campbellford*	New Plant	770,000
Caramat (American Can of Canada Limited)	New Plant	45,000
Chesterville*	New Plant	56,000
Cobourg	Extension	1,260,000
Dundas	Extension	216,000
Emo Township*	New Plant	69,709
Ernestown Township*	Extension	20,000
Guelph	Extension	2,000,000
Kingston	Extension	950,000
Meaford*	New Plant	484,800
Mississauga* (Southern Peel County Area)	Extension	11,000,000
St. Catharines	New Plant	4,855,000
Whitby	Extension	850,000
Woodstock	Extension	100,000

* Included in total costs for Provincial Projects in Table 2

Certificates issued in 1969 for works to be constructed under Provincial financing are listed in Table 2.

TABLE 2

PROVINCIAL PROJECTS

MUNICIPALITY	WATER WORKS	SEWAGE WORKS	TOTAL EXPENDITURE
Amherstburg, Anderdon & Malden	\$ 788,090	\$	\$ 788,090
Arthur		434,066	434,066
Bucke Twp.	974,043	479,750	1,453,793
Campbellford		1,066,000	1,066,000
Chesterville		562,291	562,291
Emo Township	249,613	332,222	581,835
Lake Erie Water Supply System	2,200		2,200
London Township, Ilderton Area (Lake Huron Water Supply System)	155,000		155,000
Meaford		922,800	922,800
Mississauga (Southern Peel County Programme)	4,829,700	11,229,375	16,059,075
Parkhill (Lake Huron Water Supply System)	574,300		574,300
Red Lake Township	20,100	7,200	27,300
Wallaceburg		278,653	278,653
54 TOTALS	\$7,593,046	\$15,312,357	\$22,905,403

Figures 1 and 2 indicate the value of water and sewage works systems approved from 1957 to the present.

Fig. 1

Summary of Water Works Approvals

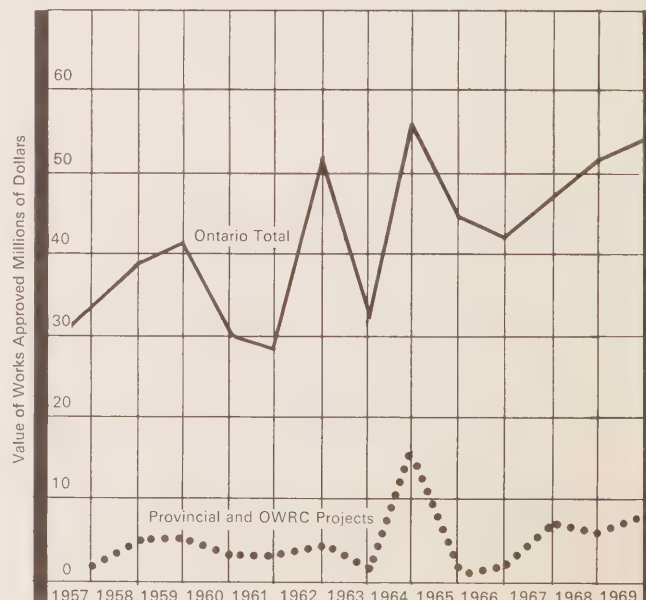
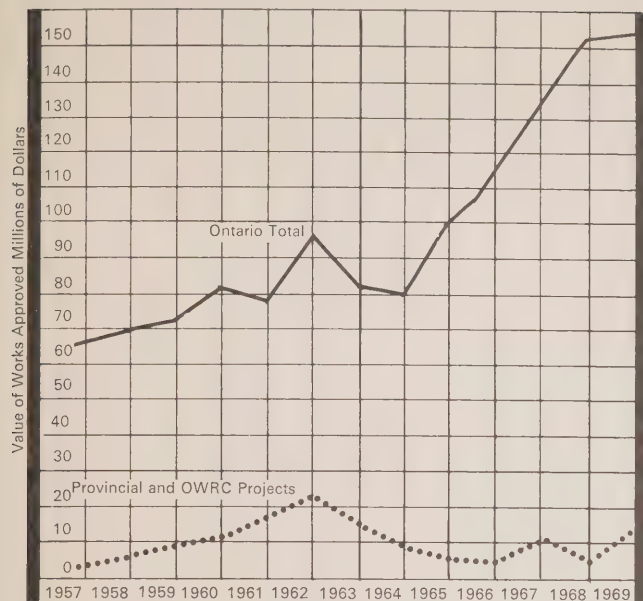


Fig. 2
Summary of Sewage Works Approvals



Miscellaneous

The Branch repeated the annual survey of all municipalities using controlled fluoridation. The survey indicated that 71 municipalities, with a population of 3.9 million, were either entirely or substantially supplied with fluoride-adjusted water.

DISTRICT ENGINEERS BRANCH

Field work of the Branch, which is responsible for both service and regulatory programs, is carried out under the supervision of five district engineers, each of whom covers designated areas in Ontario. During the year, inspections and evaluations were made in every part of the Province.

With a view to providing an optimum level of service to the people in the Province, technical staff are now located in Toronto, London, Kingston and at the Lakehead.

The routine work involved the assessment of water works and sewage treatment plants, the performance of water pollution surveys, the inspection of cattle feed lots, piggeries and chicken-raising plants relative to the possibility of their contributing to water pollution, and the evaluation of proposed plans of subdivisions and official plans with a view to providing recommendations regarding water supply and sewage disposal.

The Branch maintains an intimate contact with municipalities, water supply and pollution abatement organizations and the public in the Province.

There were 1,333 evaluations of water works performed by district staff. The number of recorded water works inspection points increased from 1,035 in 1968 to 1,145 in 1969. In addition, there were 841 evaluations of wastewater treatment plants performed, with the number of inspection points totalling 469, as compared to 494 in 1968.

As part of the water pollution control program, field staff performed 168 municipal water pollution surveys compared to 86 in 1968. These surveys are designed to locate pollution sources and promote the collection and treatment of the offending wastewater discharges. The survey reports are used to substantiate both to municipal officials and the Ontario Municipal Board the need for certain works.

To ensure the provision of proper water supply and sewage disposal, the staff of the Branch provides to the Department of Municipal Affairs an assessment of each subdivision and official plan proposed for development in the Province. There were 1,009 subdivision and 137 official plans processed in 1969, compared to 777 and 101, respectively, in 1968.

The staff of the District Engineers Branch continued to have an increasing amount of direct contact with water works and sewage works officials and personnel throughout the Province. During 1969, staff attended 705 meetings and hearings. This is an important aspect of the activities of the District Engineers Branch as it brings about a direct contact between local officials and the Commission in promoting the installation of necessary water and sewage works facilities.

Special investigations requested by municipalities, the public or senior staff of the Commission constitute a sizeable portion of the work of the District Engineers Branch. A total of 936 of these requests were received and acted upon. The following are significant examples of the type of investigation carried out:

In June, pollution by oil caused the closure of the Mooney's Bay bathing beaches of Ottawa. Extensive investigations revealed a hole in the pipeline of a company distributing heating oil to homes in the Township of Nepean. The leak resulted in the oil entering the storm sewers. The installation of two dams, two booms, three oil interceptors and the spraying of the water surface permitted the beaches to be reopened. The company was charged with water pollution and the case is now being heard.

At Millhaven, near Kingston, a heavy oil slick covered the waters of Lake Ontario. After using a boom to contain the oil, it was ascertained that an industry's oil tanks were leaking to the storm sewer. The company was charged, convicted and fined.

WATER QUALITY SURVEYS BRANCH

The Water Quality Surveys Branch is responsible for the planning of water quality management programs and related pollution controls in the drainage basins of Ontario. Inventories are maintained of municipal, industrial and other sources of pollution in relation to trends in water quality in Ontario lakes and rivers and evaluations are made of the quality of water for water supply and wastewater discharge purposes. The planning and development of improved waste controls take the form of engineering studies and reports of water quality, waste loadings and

their effect on water use. The object is to develop guidelines and waste loading limits for municipalities and industries in implementing the Commission's "Policy for Water Quality Control in Ontario". Studies of environmental water quality in the river systems and near-shore coastal waters and harbours of the Great Lakes and their connecting channels are carried out on a regular basis, with work on Lake Ontario being extended in 1969 into the winter season to provide the fullest coverage of the pollution problem. Monitoring is carried out in those locations where active and potential use of water may affect its quality. Annual publications of the collected data are released to water managers and other interested persons.

The Branch is organized into three administrative units, namely, the River Basin Surveys, Great Lakes Surveys and the Technical Services unit. Their activities are detailed in the following:

RIVER BASIN SURVEYS

The River Basin Surveys unit carried out studies on water quality in river systems to develop solutions to water pollution problems so that they can be readily translated into engineering standards for the design and operation of waste treatment systems. Specific waste loading limits are defined to ensure water quality conditions that will minimize conflict with other water uses.

Drainage Basin Studies

Major studies were carried out on the Rainy River, the Ottawa River and the Grand River. Studies were also performed on the Big Creek at Delhi, the Lynn River at Simcoe, the Boyne River at Alliston, Pringle Creek at Whitby and Hoople Creek downstream from Krafts Foods Limited, at Osnabruck.

Originally scheduled for 1968 but postponed one year because of abnormally high river flows, the Rainy River survey, covering 80 miles of the river, was conducted in September, 1969, with about 50 scientific and engineering personnel from the participating agencies involved in the field program. A key objective of the work is to determine the sufficiency of a continuous river discharge of 4000 cfs for water quality control purposes to meet expected future uses of the river. The processing of data and reporting by the various agencies have been co-ordinated by OWRC personnel, and a draft of the report will be completed and submitted to the IJC early in 1970.

The Ottawa River Drainage Basin Study which was initiated in late 1967 in conjunction with the Quebec Water Board was continued during 1969. The report presenting firm guidelines for a co-ordinated waste control program for Ontario and Quebec municipalities and industries is scheduled for completion in 1970. Subsequently, work in the Ottawa River Basin will continue by extending surveys into the river's tributaries.

The Drainage Basin Study of the Grand River which commenced in 1967 was continued with the presentation of a mathematical model relating dissolved oxygen to pollution loading levels and the calculation of organic loadings that could be discharged without impairing the

water quality of the Grand River below Brantford. Similarly, allowable waste loadings from the Waterloo Water Pollution Control Plant to the Grand River and from the Hespeler water pollution control plant to the Speed River were developed.

With the field work in the Elliot Lake and Bancroft areas nearing completion, the report on the findings of the three-year investigation into pollution from uranium mining is scheduled for completion in 1970.

Surveillance and Monitoring

Information is collected, processed and reported on the monthly, seasonal and annual variations in water quality in Ontario streams and lakes. Water quality monitoring of streams has been intensified each year since the inception of this program in 1964. In 1969, samples were collected from 650 stations compared to 463 locations in 1968 and about 200 in 1964. Officials of local conservation authorities, health units and the departments of Lands and Forests and Agriculture and Food assist in the collection of samples.

The automated data collection or robot monitoring system was expanded in 1969 from one to three units. The first unit, acquired in 1967, operates on the St. Clair River at Sarnia and the two new monitors were installed on the Ottawa River. Dissolved oxygen, temperature, conductivity, pH, turbidity and chlorides are continuously recorded by these units.

Waste Treatment Evaluations

Waste treatment evaluations were made at 58 existing and proposed municipal and industrial wastewater discharge locations.

GREAT LAKES SURVEYS

International Studies — International Joint Commission

As a result of its unique position bordering on all the Great Lakes except Lake Michigan, Ontario, through the OWRC, has continued to play a lead role in the development of joint pollution abatement programs and water quality and waste source monitoring and surveillance.

Senior management of the OWRC sit on the following IJC Pollution Control Advisory Boards:

- Interconnecting Channels and Niagara River;
- Lake Erie;
- Lake Ontario and St. Lawrence River;
- Rainy River.

Liaison is maintained with the IJC Water Levels Boards to ensure that water control schemes do not result in a deterioration of water quality.

The OWRC maintains regular monitoring and surveillance surveys each year on the lower Great Lakes and the connecting rivers and channels. This work is closely co-ordinated with the regular OWRC programs on these bodies of water and complemented by a similar effort by the U.S. pollution control agencies. Status reports on the water quality of these channels and pollution abatement programs are prepared jointly with the American agencies

for submission to the IJC. During 1969, the following cruises were carried out: Lake Huron — 1; Lake Erie — 4; St. Clair and Niagara rivers — 5; Detroit River — 6; St. Marys River — 3; St. Lawrence River — 2.

The OWRC maintains a continuous monitoring and surveillance program in the waters of lakes Ontario and Erie directly influenced by waste sources in Ontario. The results of investigations carried out in 1966 and 1967 pertaining to international pollution problems were incorporated into the Report on Pollution of Lake Erie, Lake Ontario and the International Section of the St. Lawrence River. During 1969, the two technical supporting volumes to the IJC report were submitted for final editing.

International Joint Commission hearings at Sault Ste. Marie, Michigan, and Windsor, Ontario, were held and briefs presented concerning water quality and pollution abatement measures for the Detroit, St. Clair and St. Marys rivers. A brief on OWRC contingency planning was presented at the IJC hearings held in Toronto and Cleveland in December, concerning pollution of Lake Erie from the oil and gas industry.

Nutrient Studies

The rapidly increasing fertilization and consequent algal growth in the Great Lakes has been recognized as a major problem. To arrive at solutions to the problem, a detailed sampling and accounting program covering the waste materials entering the lakes was established in 1966. Reviews of this information to date have established that control of phosphorus in water will reduce the fertilization of the lakes. Furthermore, it was noted that domestic sources account for the bulk of phosphorus inputs. These sources have gained in significance as the largely urban population in the Great Lakes Basin has increased, accompanied by the increased use of phosphorus-based detergents. A large reduction in the domestic phosphorus input will be required to correct existing lakewide and local enrichment problems. To do this successfully, both the replacement of phosphorus compounds in detergents and the provision of phosphorus removal facilities at municipal and industrial sources will be required. Work is continuing on the indexing of sources and definition of treatment requirements for individual locations.

Dredging

The dredging activities in the Ontario waters of the Great Lakes and their effect on the water quality were reviewed. It was noted that many dredging locations on the Great Lakes are within, or adjacent to harbour areas. In many cases, these locations coincide with past or current sites where untreated or inadequately treated wastes material is discharged. Pick-up and deposition of the polluted material results in the spread of polluted sediments to relatively uncontaminated portions of the lakes. Based on the information and experience at hand, it appears desirable to discontinue the transfer and disposal of polluted sediments to unpolluted parts of the lakes. Parties carrying out dredging should have the responsibility of disposing of dredged material in such a manner so as not to create

secondary problems. As a consequence of the work to date, the OWRC, in co-operation with the Canada Department of Public Works, has initiated a systematic sediment classification program in dredging areas. This will permit the establishment of disposal procedures which will reduce the pollution effects from this activity.

Thermal and Dispersion Studies

The increasing number and variety of water users (thermal and nuclear generating stations, Toronto waterfront development, regional water and sewage schemes) locating on the Great Lakes and on drainage basins tributary to the Great Lakes necessitate the formulation of an objective basis for proper water management. This requires an understanding of the near-shore water movement and quality, and the development of water quality prediction techniques to permit the location of new users with a minimum of interference with existing water uses. The movement and quality of the shore waters are complex, requiring recording instruments and advanced computer methods. Studies have been conducted both independently and in co-operation with the Hydro-Electric Power Commission at Nanticoke on Lake Erie and at Pickering on Lake Ontario since 1968 in an effort to define the physical extent and effect of discharges of thermal power plant wastes.

Dye dispersion studies were carried out at the mouths of the Credit and Grand rivers in connection with the above work. Current meter studies were conducted at three locations off Nanticoke and at two locations near Port Maitland in Lake Erie and at Toronto in Lake Ontario. Two newly developed robot water quality meters were subjected to field trials in Lake Ontario prior to their operation in Lake Erie at Port Maitland and Nanticoke.

Oil and Hazardous Material Spills

Steps were taken in 1969 to improve the organization of existing multi-agency material spill contingency arrangements. This is expected to result in quicker response to incidents through improved communication and through prior arrangement for equipment and personnel at major centres along the Great Lakes. Surveillance flights were also maintained to check regularly for the presence of oil or other material spills. Fourteen flights were carried out during the past year.

TECHNICAL SERVICES

The newly created Technical Services Unit provided for marine operations, instrumentation, drafting and office services.

Eight survey vessels were operated on the Great Lakes and inter-connecting channels, with three service vehicles maintaining supplies and administrative contact. Negotiations for replacement vessels incidental to the expiration of existing contracts were also initiated. One 28 foot launch, Monitor II, was purchased and one 62 foot vessel, Monitor III, was chartered for operation by the Commission.

Three robot water quality stations and six carbon unit installations were maintained in operation. Assistance was

also given in connection with the installation of current meters and submersible water quality stations, including the necessary maintenance.

PLUMBING AND BOATING BRANCH

PLUMBING

In the Province of Ontario the installation, maintenance and repair of plumbing, with a few minor exceptions, is controlled by the Provincial Plumbing Regulation. It is the responsibility of this Branch to maintain an up-to-date regulation and provide technical liaison with municipal inspectors. The Branch is assisted in its function of maintaining a modern code by the Plumbing Advisory Committee made up of representatives from industry, municipal regulatory authorities and engineering and water pollution control associations.

The most significant development in 1969 was the carrying out of a program of visiting many of the areas not covered by plumbing inspection. As a result of this program several municipalities have indicated their compliance with the OWRC Act regarding inspection or their intention to appoint an inspector soon.

A number of changes to the Plumbing Regulation were processed by the Technical and Advisory Committees on Plumbing and approved by the Commission.

Work was continued in collaboration with the Canadian Standards Association on the quality control of plumbing. This included activity at the national level through the CSA Advisory Council and the National Research Council's review of the National Building Code — Part 7 (Plumbing).

WATERCRAFT POLLUTION CONTROL

On January 1, 1969, Ontario's Boating Regulation governing disposal of sewage and garbage from pleasure boats went into effect and the associated watercraft pollution

control program became a reality. The Regulation was originally made in 1966, postponed twice and revised in July of 1969.

During 1969, 1,765 pleasure craft were examined. Three prosecutions were initiated for non-compliance. The first case to be heard resulted in a conviction and the accused was fined \$50.00 plus costs. Two charges are pending and Counsel for the accused is challenging the constitutionality of the Regulation.

By the end of the 1969 boating season, 91 yacht clubs and marinas were offering holding tank pump-out service in Ontario. A requirement that marinas serving toilet-equipped boats must provide pump-out services was among the provisions of a draft Marina Regulation which staff prepared for consideration by management.

In the early spring, inspections of commercial vessels were made to control the disposal of seacock filler from these vessels at the end of the winter lay-up period.

Conditions concerning winter fishing activities, particularly around ice huts, are being kept under surveillance from a water pollution point of view. Discussion is under way with other government departments on control measures.

Requests were received for information on the methods and equipment available for treating sanitary wastes generated aboard offshore petroleum drilling barges. The drilling platforms are being requested to have adequate sewage treatment facilities installed for the 1970 operational year.

REGIONAL SERVICES PLANNING BRANCH

To optimize water management and achieve long-range economies in providing water and sewage services, planning studies were undertaken in areas undergoing development throughout the Province. The Branch co-ordinated and



interpreted the information provided by other government agencies and other OWRC divisions and branches in order to clearly define the problems and to produce the most reasonable schemes based on engineering, economic and other considerations.

The Lakehead Area — Regional Water Supply and Pollution Control Study was completed, printed and distributed. Assistance was provided to a planning consultant engaged by the Lakehead Planning Board. Presentations of the report findings were made to staff of the Department of Municipal Affairs, city officials and the Lakehead Planning Board.

The Province of Ontario — South-western Area Water Supply Study progressed rapidly during the year. It is anticipated that the study will be completed early in 1970.

Considerable time was spent during the year revising and refining the development proposals for the Toronto-Centred Region as originally presented by the Metropolitan Toronto and Region Transportation Study. The Branch represented the Commission on the Task Force and the Goals Planning Committee which were formed to assist the Regional Development Branch of the Department of Treasury and Economics.

The Oshawa Area Planning and Development Study, which is jointly sponsored by the Province and the area municipalities, became active during 1969. The consulting firms which have been employed to design and estimate the water and sewage services for the areas under review were provided with pertinent information available from Commission records.

Early in the year, the Haldimand-Norfolk Study was commissioned and information and opinions were presented to the study staff. Eleven meetings concerning the study, the proposed land development within the area, and the means of servicing alternative development patterns were attended. Assistance was provided to the consultant engaged by the Commission to consider area water supply requirements. The extensions of the water system into the Kitchener-Waterloo area, together with the pooling of intake capacities, was reviewed and comments were prepared. Many meetings between staff of the Hydro-Electric Power Commission of Ontario, the Steel Company of Canada Limited and the OWRC were held in an attempt to resolve the difficulties associated with the sizing and staging of the construction of a major area water works system.

Activity in the Waterloo-South Wellington Study proceeded during the year. The prospectus for the Public Works Technical Advisory Committee was prepared, approved and distributed. Comments on the draft report by the economic consultant were submitted and, subsequently, a public presentation of the revised report was attended.

Assistance was provided to a special committee, formed under the guidance of the Deputy Minister of the Department of Transport, to evaluate the various locations being considered for a new major airport to serve the Metropolitan Toronto area. Information and opinion on water and sewage services for the selected locations were given to the economic, planning and engineering consultants engaged by the Federal Government.

Division of Water Resources

K. E. Symons, Director

D. N. Jeffs, Assistant Director

The Division of Water Resources is responsible for the assessment and management of the Province's ground and surface water resources with respect to quantity and natural quality. The work is carried forward through four branches with programs concerned with water resources surveys, test-drilling and well-construction projects, water permits, well-construction management, collection and analysis of basic hydrometric data and scientific hydrologic studies. These programs implement the Division's regulatory and inventory assignments.

The work of the Division is described hereunder according to broad divisional and specific branch activities.

Cartography

The Cartography Section supports all of the programs of the Division by preparing maps, charts, and diagrams, by procuring from a variety of sources maps, plans, aerial photographs, and mosaics, and by reproducing or arranging for the reproduction of these for internal and publication purposes.

Maps and figures were compiled and published in support of the Water Resources Survey of the Big Otter Creek Drainage Basin Report and the Data Bulletin for Northern Ontario Water Resources Studies 1966 to 1968.

ARDA Projects

Water resources surveys, which were initiated in 1964 and 1965 for two drainage basins, qualified for support under the Agricultural Rehabilitation and Development Acts. These surveys are a function of the Surveys and Projects Branch. The report for Big Otter Creek was finalized and released. Progress was made towards the completion of the report for Big Creek.

International Hydrological Decade

The International Hydrological Decade is a world-wide program designed, during the period 1965 to 1974, to advance the science of hydrology and the assessment and understanding of regional and global water resources. Several activities of the Division are contributing to the program. These include the study of the River Basin Research Branch of hydrologic characteristics of five representative river basins in eastern Ontario and the assessment of ground water and the assessment of surface water by the Hydrologic Data Branch through its regular data collection and analysis programs.

The International Field Year on the Great Lakes is a special multi-disciplinary and agency study of water balance in the Lake Ontario basin. The River Basin Research Branch is determining the ground-water contribution to the lake from the Ontario side.

The Division participated in the work of the Ontario Committee for the International Hydrological Decade and its scientific and educational subcommittees, and had representation on the Working Group on the Terrestrial Water Balance and associated sub-groups set up to plan and co-ordinate the work for the International Field Year on the Great Lakes.

Northern Ontario Water Resources Studies

The Division continued its assessment of the water resources of northern Ontario. The Surveys and Projects Branch proceeded with studies designed to determine the hydrologic characteristics of the Albany River basin and moved forward into the basins of the Winisk and Severn rivers. The Hydrologic Data Branch continued with the collection of basic hydrometric data through its own activities and in cooperation with the Water Survey of Canada and the Meteorological Branch.

The Division participated in the work of a Federal-Provincial Co-ordinating Committee on Northern Ontario Water Resources Studies. Through this Committee and an "ad hoc" Working Group, comprised of representatives of federal and provincial agencies contributing to the studies, close co-operation was maintained.

Data Processing Activities

Through close liaison with the Systems and EDP Branch of the Division of Administrative Services much progress was made in analyses, design and operation of systems of specific interest to the Division. Coding of data for input to the Water-Well Record System and the assignment of watershed codes under the STORET System were continued. The Streamflow Record System was initiated with the acquisition of the federal data in a machine-processable form and several streamflow analysis programs were implemented. A federal ground-water flow program and an evaporation calculation program were also implemented.

As a result of IBM QUIKTRAN training provided to staff members, several programs dealing with statistical analyses, chemical analyses and curve fitting were run using the QUIKTRAN terminal.

The Division participated in the work of EDP Committees on OWRC Library Files, STORET and Laboratory Data Handling Study — Phase II.

SURVEYS AND PROJECTS BRANCH

The Surveys and Projects Branch was active in municipal ground-water surveys, municipal test-drilling and well-construction projects, regional studies, drainage basin surveys, and special investigations of ground-water pollution and water-supply problems.

Work completed or in progress included four drainage basin surveys in southern Ontario, three drainage basin surveys in northern Ontario, three regional studies, 21 municipal ground-water surveys, 17 test-drilling or well-construction projects, and 41 special investigations. Tables 1 and 2 and Figure 1 present a summary of these activities.

Drainage Basin Surveys

Work in southern Ontario continued on the preparation of reports on water resources surveys carried out in the Upper Nottawasaga River and the Big Creek drainage basins. The report on the Big Otter Creek Survey was released. Field work was initiated in the Moira River basin.

In northern Ontario, the survey in the lower reaches of the Albany River continued and surveys were initiated in the Severn River and the Winisk River basins.

Regional Studies

Planning and field work were initiated to determine the availability of ground-water resources for three regions of the Province: the Counties of York and Ontario — Northern Area; the County of Halton and region; and the Niagara Peninsula Region. The results of the studies are to be included in reports on regional water-supply requirements prepared jointly with the Division of Sanitary Engineering.

TABLE 1

SUMMARY OF SURVEY ACTIVITIES — 1969

Activity	Location	Field Work Completed	Report Released
Drainage Basin Surveys	Big Creek	X	
	Big Otter Creek		X
	Upper Nottawasaga River	X	
	Moira River	—	
	Lower Albany River	X	
	Severn River	—	
	Winisk River	—	
Regional Studies	Counties of York and Ontario	—	
	County of Halton	X	
	Niagara Peninsula	—	
Municipal Ground Water Surveys	Beeton		X
	Centralia		X
	Creemore	X	
	Drury, Denison, Graham and Waters Townships*	X	
	Echo Bay*		X
	Georgina Township		X
	Glen Williams*		X
	Guelph		X
	Hastings*		X
	Landsowne*	X	
	Maxville*		X
	Nepean Township		X
	Omeme*		X
	Ottawa-Carleton Region	X	
	St. Charles*		X
	Stirling	X	
	Summerstown*		X
	Tiverton*		X
	Verner*		X
	Wasaga Beach	X	
	Webbwood*		X

* Proposed provincially-owned system

Municipal Ground Water Surveys

During 1969, the Branch was engaged in 21 surveys to

evaluate ground-water conditions for municipal water-supply purposes. Ten of the surveys were continued from the previous year and eleven new surveys were initiated. Fifteen ground-water survey reports were released.

One of the surveys was carried out for the Regional Municipality of Ottawa-Carleton to assist in water resources planning and comprised 24 municipal ground-water surveys within an area of about 1,100 square miles.

The surveys indicated that ground-water supplies were poor-to-marginal in the vicinity of Beeton, Centralia, Township of Georgina, Hastings, Maxville, St. Charles, Summerstown, Verner and Webbwood. Surveys in six municipalities indicated favourable conditions for the development of ground-water supplies.

Test Drilling and Well Construction Projects

The Branch participated in 14 test-drilling projects and three well-construction projects. Nine of the test-drilling programs and all of the well-construction programs were carried forward from the previous year. Reports were released on 13 test-drilling projects and three well-construction projects. At the end of the year, only one test-drilling program was active.

Test-drilling projects located suitable water supplies at Baden, Barry's Bay, Callander, Lancaster, L'Orignal, Westport and Woodville. Efforts were unsuccessful in locating sufficient supplies at Beardmore, Casselman, Killaloe Station, Thornbury, Vermilion Bay and Webbwood. All test-drilling programs were for proposed provincially-owned systems.

TABLE 2
SUMMARY OF PROJECT ACTIVITIES – 1969

Activity	Location	Field Work Active	Report Released	Wells Completed Test Production
Test Drilling	Baden		X	2
	Barry's Bay		X	2
	Beardmore		X	3
	Callander		X	10
	Casselman		X	4
	Glen Williams	X		
	Killaloe Station		X	3
	Lancaster		X	2
	L'Orignal		X	6
	Thornbury		X	12
	Vermilion Bay		X	3
	Webbwood		X	2
	Westport		X	2
	Woodville		X	6
Well Construction	Oak Ridges		X	1
	Plantagenet		X	1
	Schomberg		X	2

Special Investigations

Forty-one investigations into ground-water pollution and water-supply problems were completed or were in progress.

Seven investigations were carried forward from the previous year and ten were in progress at the end of the year. Sixteen of the problems related to ground-water pollution and the remainder to water-supply problems and well-performance evaluations.

Fig. 1
Active and Completed Surveys
Projects and Investigations

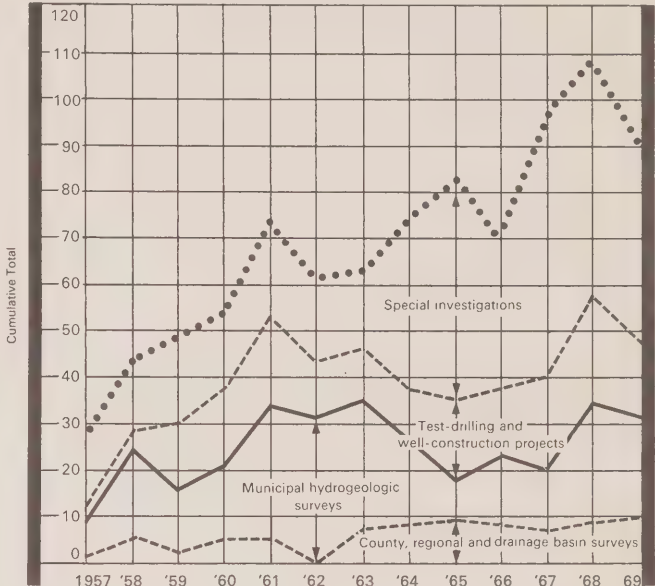


Fig. 2
Types of Investigations

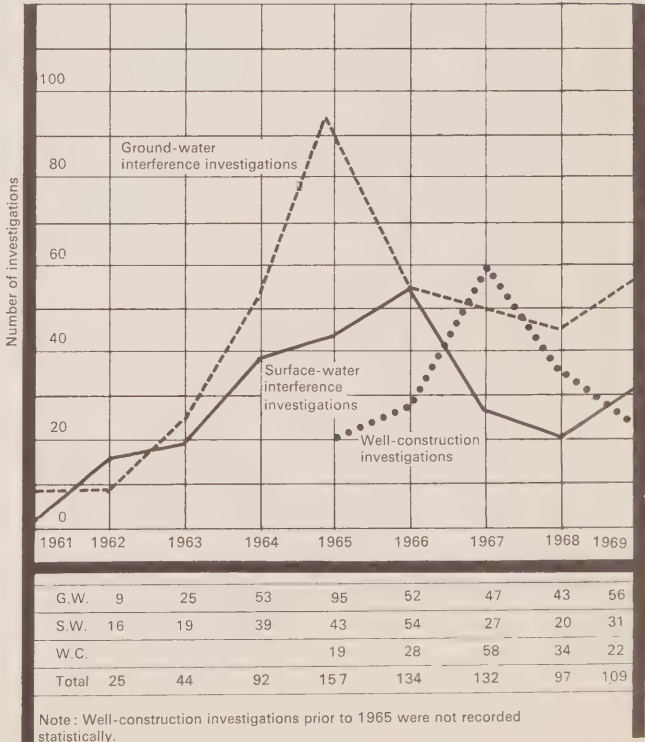
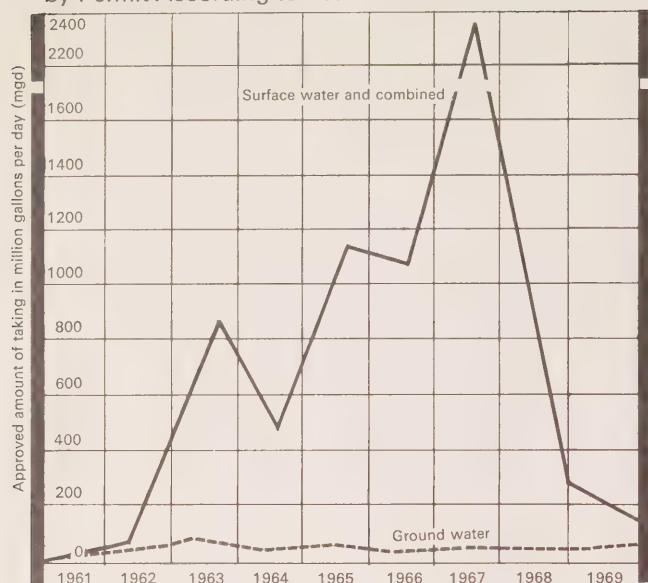


Fig. 3

Amount of Water Taking Authorized by Permit According to Year and Source



WATER AND WELL MANAGEMENT BRANCH

The activities of the Water and Well Management Branch were carried out under two programs: water management and well-construction management.

The main activities under the water-management program included processing applications and permits for the taking of water, investigating and reporting on complaints concerning alleged interference with water supplies and enforcing associated legislative and permit requirements. Under the well-construction management program, activities mainly concerned licensing water-well contractors, checking locations of new wells and their sanitary construction, investigating complaints against water-well contractors

and possible infractions of statutes and regulations, and developing revised and additional water-well construction regulations. Figure 2 shows the surface-water and ground-water interference investigations carried out since 1961 and the well-construction investigations since 1965.

WATER MANAGEMENT PROGRAM

Applications and Permits

Table 3 shows a summary of water-permit data for 1969. Of the 487 permits issued, 289 were for irrigation, 58 for municipal-supply purposes, 65 for industrial purposes, 17 for commercial purposes and 58 for recreational purposes. A total of 247 permits were cancelled, most of them because of a change in ownership of properties, and 201 amendments were authorized by the Commission.

Table 4 shows the number of permits issued and the amounts of takings authorized for 1969, according to drainage basin, source and purpose. Table 5 is a summary of amounts of water taking approved since 1961. Figure 3 shows graphically the amounts and purposes of authorized surface-water and ground-water takings since 1961.

Renewal Applications and Permits

One hundred and twenty-eight renewal applications were received for Permits To Take Water originally issued from 1963 to 1966. Of these, 108 were originally issued in 1964. By December 31, 1969, 177 permits were renewed, 21 applications had been withdrawn, one application was under active consideration and one was awaiting additional information.

Water Management Investigations

Eighty-seven ground-water and surface-water interference problems were investigated during the year, an increase in number from 1968.

TABLE 3

SUMMARY OF WATER PERMIT DATA FOR 1969

SOURCE	APPLICATIONS						
	Carried Forward From 1968	Received in 1969	Refused Withdrawn or not Required	Approved		Under Review on Dec. 31, 1969.	Amount of Water Taking Approved by Permit* (MGD)
				By Letter	By Permit		
Ground Water	41	150	62	36	90	3	34.07
Surface Water	64	382	48	1	377	20	132.98
Ground and Surface Water	7	19	5	—	20	1	8.98
Total	112	551	115	37	487	24	176.03

*Does not include water takings approved by letter of approval or by permits where conditions of taking rather than amounts were specified.

TABLE 4

PERMITS ISSUED AND TAKINGS AUTHORIZED IN 1969 ACCORDING TO DRAINAGE BASIN, SOURCE AND PURPOSE

DRAINAGE BASIN	SURFACE WATER					GROUND WATER					COMBINED TAKING					TOTALS
	Comm.	Ind.	Irr.	Mun.	Rec.	Comm.	Ind.	Irr.	Mun.	Rec.	Comm.	Ind.	Irr.	Mun.	Rec.	
St. Lawrence River							2 .60		1 .13							3 .73
Ottawa River		3 .40	2 .80	3 2.19	+3		3 .32		9 1.38							20+3 5.09
Lake Ontario	1+1 .07	7 6.94	17 2.79	1 .03	1+18 .12		9 6.71	2 .35	11 7.06	1 .04		2 .86	3 1.17		1 .02	56+19 26.16
Lake Erie & Lake St. Clair	3+1 .42	9 9.51	222 65.86	1 .13	+10	2 .11	7 1.62	12 3.98	11 5.93			1 1.46	12 5.45			280+11 94.47
Lake Huron	7 .80	12 5.57	19 5.78	3 13.42	+22	1 .50	2 1.07		16 3.55							60+22 30.69
Lake Superior	1 .04	4 2.49		1 .04	+2		1 .72									7+2 3.29
Hudson Bay		3 15.58												1 .02		4 15.60
TOTALS	12+2 1.33	38 40.49	260 75.23	9 15.81	1+55 .12	3 .61	24 11.04	14 4.33	48 18.05	1 .04		3 2.32	15 6.62	1 .02	1 .02	430+57 176.03
GRAND TOTALS		320+57 132.98					90 34.07					20 8.98				

NOTE: (i) In each square the top number refers to permits issued, with the amount of authorized water takings in IMGD below.
(ii) The number following a "+" shows the permits issued under special conditions and having no rate or amount specified.
(iii) Purposes: Comm. — Commercial; Ind. — Industrial; Irr. — Irrigation; Mun. — Municipal; Rec. — Recreational.

TABLE 5

SUMMARY OF AMOUNTS OF TAKING APPROVED BY PERMIT FOR VARIOUS PURPOSES

PURPOSE	1961 MGD	1962 MGD	1963 MGD	1964 MGD	1965 MGD	1966 MGD	1967 MGD	1968 MGD	1969 MGD
Commercial	0.28	3.88	0.36	1.48	0.36	1.45	0.48	0.61	1.94
Industrial	10.34	10.45	26.38	329.14	947.91	1,310.08	2,238.94	55.58	53.85
Irrigation	0.38	8.88	774.09	51.49	134.82	94.23	96.46	69.11	86.18
Municipal	6.53	12.13	21.24	103.62	31.49	17.69	18.16	162.15	33.88
Recreation	—	—	0.93	0.23	0.05	0.07	4.31	0.02	0.18
TOTALS	17.53	35.34	823.00	485.96	1,115.63	1,423.52	2,358.35	287.47	176.03

NOTE: The amounts do not include water takings approved by letters of approval or by permits where conditions of taking rather than amounts were specified.

Ground-Water Interference Investigations

Fifty-six investigations of ground-water interference problems were carried out and reports were completed for 53 of the problems during the year. Some of the investigations required repeated field trips to assemble sufficient data to establish causes and responsibilities clearly.

The municipalities in which investigations were carried out are indicated below. The figures in brackets indicate the number of separate complaints when more than one was investigated.

Townships: Blanshard, Caledon (3), Chinguacousy (4),

Clarke, Delaware, Downie, Dunn, Esquesing, Front of Leeds & Lansdowne, Johnson, King (2), Kingston, London, Markham (5), Mersea, North Gwillimbury, North Oxford, Borough of North York, Nottawasaga, Saltfleet, Borough of Scarborough, South Dumfries (3), Stephenson, Tecumseth (2), Toronto, Townsend, Vaughan (4), West Flamborough, West Oxford, Whitchurch, Woodhouse.

Towns: Bradford, Kapuskasing, Mississauga, Pembroke, St. Mary's.

Regional Municipalities: Ottawa-Carleton (2)

City: Sault Ste. Marie (2).

The well-interference studies in the townships of Blanshard, Chinguacousy, Markham, Vaughan and Woodhouse and in the Town of Pembroke were complex and required numerous field investigations. Studies were continued in the Glen Cairn and Kanata subdivision areas of the Regional Municipality of Ottawa-Carleton. Details of some of these studies follow.

Township of Blanshard — A number of private well owners expressed concern that the operation of a high-capacity well for industrial purposes would cause serious interference with their well-water supplies. Reconnaissance surveys were carried out prior to the operation of the industrial well to establish water levels, and automatic recorders were installed on a dug well and a drilled well to monitor water levels on a continuous basis. Water levels were observed in the area after the industrial well was placed into production; however, no evidence of serious interference with private well supplies was detected. Regular water-level measurement surveys will be continued for some time.

Township of Markham — Three separate instances of de-watering, one by a gravel pit operation and two by road construction, required numerous investigations. The gravel pit operation was requested to construct a berm in the pit to allow the ponding of water in the pit rather than pumping to a nearby watercourse. The ponding was partially successful in maintaining water levels in several nearby, private dug wells. It is expected that a proposed new ponding in the pit will virtually eliminate any interference problems. In both cases of interference by road construction, the construction had intersected water-bearing materials during excavation which required draining and de-watering. The owners of the projects were co-operative in the restoration of affected private well supplies.

Township of Woodhouse — De-watering carried out at a limestone quarry was found to be largely responsible for the serious lowering of water levels in wells near the quarry. Several field trips were necessary to determine the trend of water levels with varying pumping rates over time and to determine the exact extent of interference due to quarry de-watering, as previous oil-well drilling operations had been responsible for well-interference complaints at an earlier date. Marginal water supplies were also noted in the area as several of the residents' wells were found to have chronic water-supply problems. Valid complaints were settled by the quarry operator.

Town of Pembroke — De-watering of an excavation for a new water pollution control plant was alleged to have caused a serious water-level lowering in some nearby private wells. Several field trips were necessary to establish water-level trends with pumping and also to observe the recovery of water levels once pumping ceased. Part of the alleged interference was determined to be the result of a significant decrease in precipitation; however, some significant lowering was detected as a result of de-watering. After considerable discussion with representatives of the Branch, the local municipality supplied water in sanitary cans to those residents most seriously affected.

Surface-Water Interference Investigations

Thirty-one investigations of complaints concerning interference with surface-water supplies or depletion of stream-flow were made and reports were completed for all of the investigations.

The municipalities where investigations were carried out are indicated below. The figures in brackets indicate the number of investigations in municipalities where more than one problem occurred.

Townships: Adjala, Brantford, Brock, Burford, Chinguacousy, East Flamborough, Erin, Goderich, Kenyon, King, Mono, Mulmur, North Dumfries, Nottawasaga, Oakland, Pickering (2), Tecumseth, Uxbridge (2), Vaughan, Waterloo, Wellesley, Whitby, Whitchurch (3).

Towns: Burlington, Oakville (2), Richmond Hill.

Water-Taking Investigations

During the year, 345 farms were visited. The water-taking practices of 12 permit holders were checked and 99 applications for permits were obtained. In addition, 55 farm owners were visited specifically to obtain data required to process applications.

WELL CONSTRUCTION MANAGEMENT PROGRAM

Well Contractors

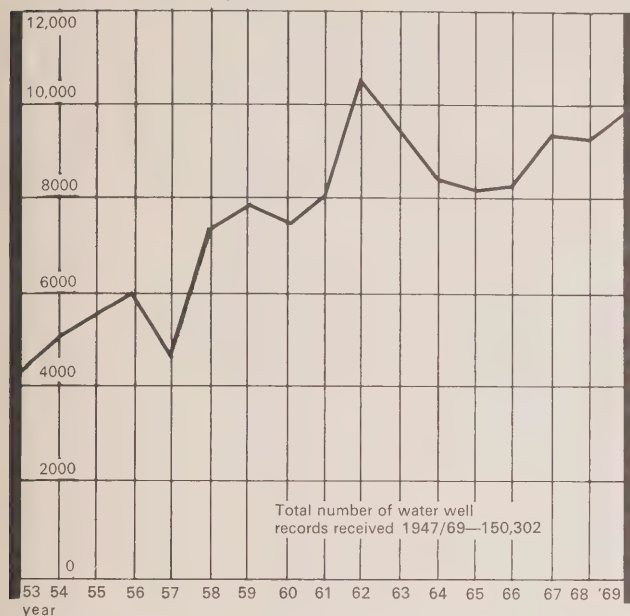
Four hundred and forty-one licences were issued in 1969 for the business of boring or drilling wells for water; 31 licences were issued to boring contractors and 410 were issued to drilling contractors. Records for 9,874 water wells were received during 1969. The number of records received annually for the years 1954 to 1969, inclusive, is shown in Figure 4. Four inspectors visited water-well contractors on 1,062 occasions, made 7,033 checks on the locations of wells and made 1,562 checks for sanitary well construction.

Changes to the Water Well Regulation made under The Ontario Water Resources Commission Act received the approval of the Lieutenant Governor in Council on February 6, 1969. The new Regulation, Ontario Regulation 46/69, was filed by the Registrar of Regulations on February 17, 1969. This Regulation allows for the use of revised water-well record forms, suitable for electronic data processing, increased fees for well contractors' licences, increased experience required for new boring contractors, more stringent well-construction practices to control ground water contamination, and more specific regulations regarding the sealing, venting, testing, disinfection and maintenance of wells, and the installation of pumps on wells.

During the year, a boring contractor was prosecuted on two charges, one for failure to submit a water-well record to the Commission and the other for failure to supply the owner with his copy of the water-well record. The contractor was found guilty on both charges.

Members of the Branch staffed a display booth at the Canadian Water Well Contractors' Association Annual Convention and contributed an article for the Official Program.

Fig. 4
Number of Water Well Records
Received Annually



Investigations Concerning Well Regulations

Twenty-two investigations concerning well regulations were carried out during the year and reports were completed for twenty of these.

The municipalities where investigations were carried out and the number of investigations in municipalities where more than one problem occurred are listed below:

Townships: Blenheim, Chinguacousy, Clinton, East Gwillimbury, Hallowell, Markham, Marmora (2), North Gwillimbury (2), Nottawasaga (2), Oro, Pickering, Walpole, Waters, West Gwillimbury (2), Whitechurch, Yarmouth.

Town: Burlington.

A water quality study and report were completed for the area around the Hamlet of Harrowsmith in the Township of Portland.

Well Coding

A program to plot and code all water-well records received since 1967 was commenced in preparation for electronic data processing of these data. A total of 7,242 water-well records were plotted and coded in preparation for keypunching.

HYDROLOGIC DATA BRANCH

During the course of the year, the Hydrologic Data Branch collected, analyzed and distributed hydrologic data. Networks for the collection of ground-water and surface-water data were operated to provide basic information for general and specific programs and for public purposes.

Observation Wells

The network of observation wells was expanded in 1969 to 158 wells through the addition of 48 wells and the loss of seven wells where access or observers were no longer available. Sixty-two wells are equipped with water-level recorders, while ninety-six are measured manually. Figure 5 shows the historic development of the observation well network. All observers are volunteers and their valuable public service is gratefully acknowledged.

Hydrogeologic Data

Water-well records are received through the Water and Well Management Branch from water-well contractors. An additional 5,903 records were placed on open file during the year. Water Resources Bulletin 2-7 in the ground-water series was prepared for printing. It contains data abstracted from water-well records and observation well records for the years 1960 to 1964, inclusive, for the south-central area of Ontario.

The work of converting the system of water-well records and their data from a manual file to an electronic system continued, with support from a number of internal and external units. Impetus to initiate the change came from the needs of the International Field Year on the Great Lakes and work was started on the counties wholly or partly in the Lake Ontario Drainage Basin. The River Basin Research Branch provided general co-ordination, and liaison with the Division of Administrative Services. The Cartographic Section provided topographical maps, showing lots and concessions for plotting well locations, and it completed this work for all of the counties. The Water and Well Management Branch plotted wells and coded records for wells constructed in 1968 and 1969. There are now 7,297 records ready for keypunching for this period. Casual staff in the Hydrologic Data Branch continued with the plotting and coding of the 132,000 water well records on file for the period prior to 1968. With the plotting during the year of 36,000 well locations, the work was completed for the Lake Ontario basin and brought the total plotted to 71,400. Approximately 33,000 records were coded, bringing the total to approximately 44,000. The federal Inland Waters Branch supported the work by determining the co-ordinates and surface elevations of wells and by providing salary funds for some of the casual help.

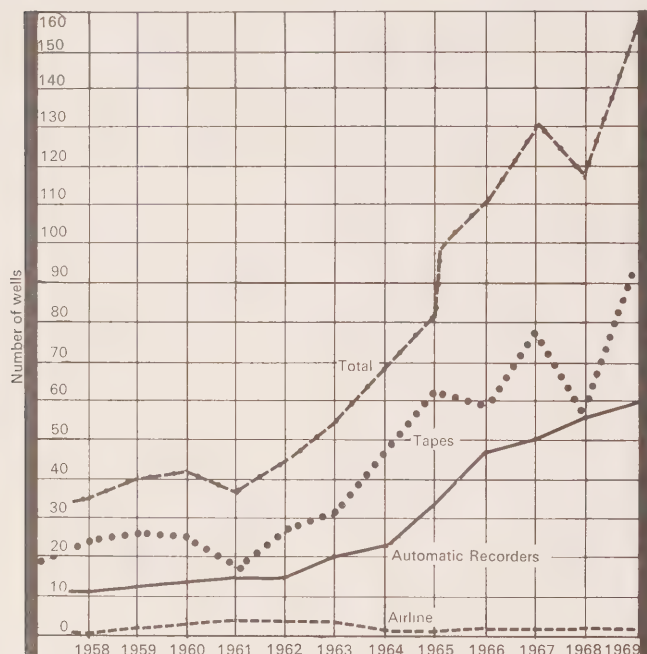
A map showing probable ground-water yield for the County of Lambton was prepared and printed. Distribution was scheduled early in 1970. A similar map was under preparation for the County of Kent. These are the first two in a series.

Public Enquiries

There was a steady demand for hydrogeological information from individuals and professional people interested in locating and developing ground water. As a result of public enquiries, 77 summaries of ground-water conditions were prepared, 112 letters were written and 3,906 copies of water-well records were distributed. Ground-water information was also released through 689 telephone calls. One hundred and eighty-four visits were made to the Branch by persons who consulted the records or discussed ground-water conditions with staff members.

Fig. 5

Observation Wells in Operation



Surface Water Data

Surface water data were assembled through independent efforts by the Branch and through co-operative arrangements with a federal agency. A summary of streamflow gauging stations by operating agency is presented in Table 6.

TABLE 6

SUMMARY OF TYPES OF STREAMFLOW GAUGING STATIONS BY OPERATING AGENCY

Operating Agency	St. Lawrence Drainage Basin		Hudson Bay Drainage Basin		Total
	Recording	Manual	Recording	Manual	
Hydrologic Data Branch	14	87	13*	4	118
Inland Waters Branch — supported by the Division of Water Resources	36	2	23		61**
River Basin Research Branch	20	10	0	0	30

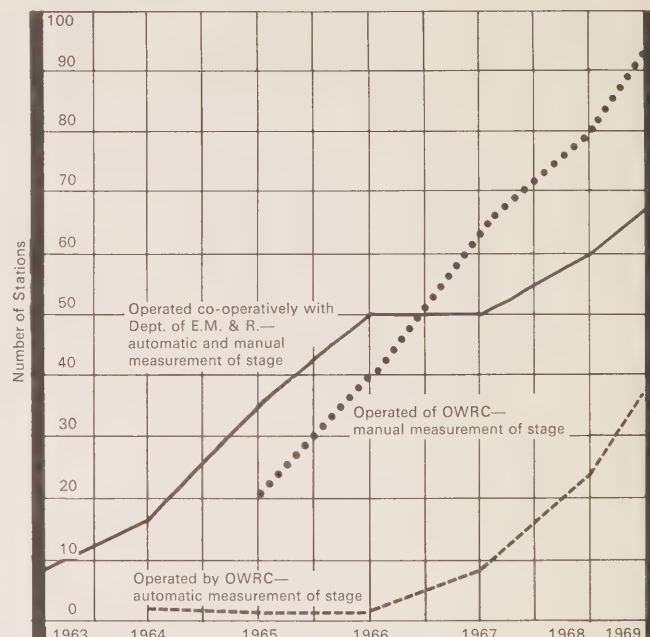
* — 11 are recording during open-water season only.

** — does not include 2 recording and 3 manual lake gauges.

An historical record of the types and numbers of streamflow stations operating by years since 1963 is shown in Figure 6.

Fig. 6

Streamflow Gauging Stations Operated by the Branch or Maintained Co-operatively with the Federal Government.



At the request of the Division, the Water Survey of Canada (a section of the Inland Waters Branch, Department of Energy, Mines and Resources) increased the number of streamflow gauging stations operated by it from 54 to 61, exclusive of lake level gauges, under a cost sharing arrangement.

The Branch operated 118 streamflow gauging stations and made 746 measurements at 89 other sites during the summer months. The number of stations supporting various programs is as follows: water quality monitoring — 46; radiological pollution investigation — 24; drainage basin surveys — 11; northern Ontario water resources studies — 17; and special studies — 20.

Water Resources Bulletins 3-1 and 3-2, containing streamflow data for stations operated by the Branch for the years 1965 to 1966 and 1966 to 1967, respectively, were published. Data for Bulletins 3-3 and 3-4, for the years 1967 to 1968 and 1969 were being prepared for publication.

Northern Ontario Water Resources Studies

The collection of hydrological and geological data was continued in the Hudson Bay drainage basins. Streamflows were measured regularly at 17 sites throughout the summer. Automatic water-level recorders were installed and operated at 13 sites. Eleven of these were operated during the summer season only and two for the full year. Under this program, the Water Survey of Canada operates 23 recording streamflow gauges and five lake level gauges on a shared-

cost basis. The Branch shared in the cost of the construction of one new streamflow station with a recorder on the Severn River at Limestone Rapids and the construction of cableways on the Kawinogans and Roseberry rivers.

Five observation wells were installed during the year. These resulted from bore holes drilled by the Federal Government for its engineering studies and were left for the Commission's use by arrangement. The number of observation wells in operation is 16.

Six snow courses were in operation during the year. The Lower Severn river basin was mapped to complete the pleistocene geology of the area.

Water Resources Bulletin 1-1, containing data collected during the period 1966 to 1968, was published. A bulletin with data collected in 1968 and 1969 was under preparation.

Radiological Pollution Investigations

Eighteen streamflow gauging stations in the Elliot Lake area and six in the Bancroft area were operated in support of the radiological pollution investigations. The investigations officially ended in the summer. Eleven of the streamflow stations in the Elliot Lake area and two in the Bancroft area will be incorporated into the regular network.

Ground Water Assessment Program

The field work for the assessment of ground-water conditions in an overburden aquifer and in the Salina rock formation at Wainfleet, in the County of Welland, was completed. Three wells were constructed at the site and a pumping test carried out on one of the wells. One well was equipped with an automatic water-level recorder and five piezometers were established at different water-bearing horizons. Office analysis continued.

Drilling was in progress for a ground-water assessment program in the Township of Albion.

Both projects will also serve as contributions to the International Hydrological Decade Program.

RIVER BASIN RESEARCH BRANCH

The activities of the River Basin Research Branch were concentrated on scientific hydrologic studies of five river basins in southern Ontario, forming a large portion of the

Commission's contribution to the International Hydrological Decade. Specialized studies, such as soil analyses, electric well logging and geophysical surveys, were carried out in support of programs of the Branch and the Division. Under the International Field Year on the Great Lakes program, the Branch continued its studies of ground-water in the Lake Ontario basin and particularly of ground-water inflow to Lake Ontario.

Representative Basin Studies

The study of hydrologic and hydrogeologic phenomena in five drainage basins, representative of major geomorphologic regions in southern Ontario, continued. This work is also a contribution to the program of the International Hydrological Decade.

Table 7 shows a summary of the hydrometric stations operated by the Branch in its five representative basins. The number of manual observation wells increased, as more abandoned, private wells were incorporated into the network to aid in ground-water flow studies. The number of satellite meteorological stations decreased with a minor consolidation of the network.

Blue Springs Creek

Studies in the Blue Springs Creek basin were being carried out in co-operation with the University of Guelph. The university continued its bi-monthly water quality sampling program at one automatic streamflow gauging station. The samples were analyzed by the OWRC laboratory.

Routine streamflow measurements were continued and three sets of water samples were collected for chemical analyses from the streams at the gauging stations.

General maintenance work was carried out and data were collected from the existing observation well network.

The geophysical survey, using seismic techniques, was completed. A preliminary report was prepared on the survey which was designed to determine the depths to bedrock in certain areas and to aid in the tracing of buried bedrock valleys.

Bowmanville, Soper and Wilmot Creeks

The streamflow stations were maintained and water samples were obtained for chemical analyses during some of the routine metering surveys. One automatic streamflow

TABLE 7
SUMMARY OF HYDROMETRIC STATIONS OPERATED BY THE RIVER BASIN RESEARCH BRANCH IN REPRESENTATIVE BASINS

BASIN	METEOROLOGICAL STATIONS		SNOW COURSES	STREAMFLOW GAUGING STATIONS		OBSERVATION WELLS		SOIL MOISTURE STATIONS
	MAIN SATELLITE			Recording Manual		Recording Manual		
Blue Springs Creek	—	—	—	—	5	5	11	—
Bowmanville, Soper & Wilmot Creeks	2	14	12	13	2	11	41	16
East & Middle Oakville Creeks	1	5	8	4	—	2	30	—
Venison Creek	1	3	—	2	1	4	3	—
Wilton Creek	2	5	—	1	2	4	11	—
TOTALS	6	27	20	20	10	26	96	16

gauging station, complete with an artificial control, was installed and modifications to the artificial control at one existing station were carried out to improve winter measurements. One artificial control was constructed at a manual station to obtain a better stage-discharge relationship. Conductivity measurements were taken at certain gauging stations in an attempt to determine the baseflow stage of the streams. A report for internal circulation was prepared on the design and construction of the artificial control at an automatic gauging station on Bowmanville Creek.

General maintenance work was carried out and data were collected from all the observation wells. Draft reports were prepared on a preliminary assessment of the water-balance budget, the geochemistry of ground water in the basin, and on the ground-water storage capacity of the basin. Hydrometer analyses were carried out on samples taken from an earlier test-drilling program. Pumping tests were conducted on three of the Commission's observation wells to determine aquifer coefficients and to aid in an assessment of ground-water quality and flow pattern.

The soil moisture measurement network was supplemented with the addition of twelve access tubes at six stations in the Bowmanville and Soper creeks sub-basin. Nine soil moisture surveys were carried out on the existing network in the Wilmot Creek sub-basin. A draft report was prepared summarizing the soil moisture installations and outlining the need for the satellite stations in the two sub-basins.

A water and land-use survey was completed with 294 personal interviews being conducted with local residents in the field.

Special Geophysical Investigations

In addition to the geophysical surveys carried out in the representative basins and under the International Field Year on the Great Lakes program, studies were undertaken in support of programs of other branches of the Division.

To assist in the interpretation of geologic sequences during test-drilling projects, gamma and electric logs were obtained in nine wells for the Surveys and Projects Branch and in three wells for the Hydrologic Data Branch.

Seismic and electrical resistivity surveys were carried out at Casselman and Creemore in support of hydrogeological surveys undertaken by the Surveys and Projects Branch.

A report was completed on the geophysical investigations carried out at Nakina as part of the Northern Ontario Water Resources Survey. The report was prepared in conjunction with James F. McLaren and Associates, consulting engineers hired by the Commission.

Some preliminary work was carried out by the Branch in order to become acquainted with equipment necessary to undertake analogue model studies on selected drainage basins. A member of the Branch journeyed to the Illinois State Water Survey in Urbana, Illinois, to discuss the setting up of ground-water analogue models with experts in this field. The excitation-response apparatus was set up and preliminary designs for a model of the Soper Creek sub-basin were commenced.

Five Sacramento precipitation storage gauges were measured by the Branch. The marking of snow courses was completed in the Wilmot Creek sub-basin and nine snow surveys were carried out. Preliminary analyses of the snow survey data were undertaken to assess water equivalent of the snow pack in relation to spring runoff.

Three field trips were organized and conducted in the basin. One took place while Professor Nash, the Ontario-visiting IHD professor, was with the Division; another was to acquaint staff and students from the Faculty of Forestry of the University of Toronto with various types of hydrometric installations; the third was to show conditions in the research basins to Dr. V. A. Korobainikov, a visitor from the U.S.S.R.

East and Middle Oakville Creeks

In conjunction with streamflow measurements, four sets of water samples were taken for chemical analyses. One existing artificial control was modified to prevent bank erosion during periods of high flows. Preliminary studies were undertaken on the water balance in conjunction with the compilation and plotting of the streamflow hydrographs.

General maintenance work was carried out on all the observation wells. Four sets of water samples were collected from the wells for chemical analyses. A field study was undertaken to map areas where ground water discharges directly to the creeks. Twenty-five soil samples were analysed. A report was prepared on the geophysical survey using electrical resistivity techniques. This survey was originally undertaken to provide ground control during airborne resistivity work by the Geological Survey of Canada. Due to electrical interference, the airborne survey was not successful.

The eight snow courses were measured eight times and a preliminary report was prepared on the results of the first year's survey. A preliminary soil moisture measurement network was designed; however, no access tubes were installed.

Venison Creek

Three sets of water samples were taken for chemical analyses in conjunction with routine streamflow metering surveys. Internal reports were prepared on the design and installation of the two existing automatic gauging stations.

General maintenance work was carried out and data were collected from all of the observation wells.

Wilton Creek

One set of water samples was taken for chemical analyses during routine streamflow metering surveys. Data were collected from the one Sacramento precipitation storage gauge in the basin.

Data were compiled and collected from all of the previously-installed observation wells. One set of water samples was collected from the wells for chemical analyses. Pumping tests were carried out on two of the Commission's observation wells to determine aquifer coefficients for the



bedrock in the area. Geological reconnaissance mapping was continued.

Soils Laboratory Studies

In support of test-drilling projects and geological investigations carried out by other branches of the Division, 138 soil samples were processed in the Branch's soils laboratory. Sieve analyses were undertaken on 39 samples, hydrometer analyses on 17 samples and both sieve and hydrometer analyses were carried out on 82 of the samples. The Hydrologic Data Branch submitted nine of the samples and the Surveys and Projects Branch submitted 129.

International Field Year on the Great Lakes

Hydrogeologic studies were continued in the Lake Ontario drainage basin as part of the Commission's contribution to the study of ground-water inflow to the lake under the IFYGL program. A preliminary report was prepared on the approach to be used to study ground-water inflow into the lake basin and included references to the use of water chemistry to trace ground-water movement. In the Forty Mile Creek basin, established as one representative area within the drainage basin, the installation of three observation wells, each with several small-diameter piezometers, was completed. A pumping test was undertaken as part of the well installation program. One well was equipped with an automatic recorder. Monitoring of water levels in the piezometers was undertaken in conjunction with the collection of water-level data from a network of observation wells established in 1968. A detailed hydrochemical study was completed as an aid in the determination of the ground-water flow pattern in the basin. A study of gas wells in the area was undertaken to help assess the position of the ground-water divide in the southern portion of the basin.

Preliminary geological reconnaissance mapping was carried out in the Moira River basin which has been selected as another representative area within the Lake Ontario drainage basin.

Gamma and electric logging was carried out on four wells in conjunction with the IFYGL program.

Ground-water and geology reconnaissance work was carried out in the Lake Ontario basin, and areas of major overburden aquifers were outlined for approximately 85 per cent of the total area.

Members of the Branch were active on the Ground Water, Surface Water and the Soil Moisture sub-groups of the IFYGL Working Group on the Terrestrial Water Balance. A liaison was maintained with the United States Geological Survey and with the Federal Department of Energy, Mines and Resources, participating agencies in the study.

Water-well records were prepared for electronic data processing for the IFYGL study. This was a multi-branch activity with support from the Inland Waters Branch, Department of Energy, Mines and Resources, in the plotting and interpretation of elevations and co-ordinates.

Appendix

PAPERS AND ADDRESSES BY OWRC PERSONNEL

Industrial Wastes

Armstrong, T. D., Boyko, B. I.
Treatment of Potato Processing Wastes at Salada Foods Limited, Alliston. 16th Ontario Industrial Waste Conference, Niagara Falls, June 1969.

Clarke, H. A.
Industrial Pollution Control, Niagara Section of the Chemical Institute of Canada, October 1, 1969.

Clarke, H. A., Turner, E.W.C.
The OWRC Regulatory Control Program for the Pulp and Paper Industry. Fifth Paper Industry Conference on Air and Stream Improvement, Toronto, October 22, 1969.

Laboratories

Bennett, E. A.
An investigation of daily variations in chemical, bacteriological and biological parameters at two Lake Ontario locations. Part II — Bacteriology. Proceedings, Twelfth Conference on Great Lakes Research, Ann Arbor, May 1969.

Brydges, T. G.
An investigation of daily variations in chemical, bacteriological and biological parameters at two Lake Ontario locations. Part I — Chemistry. Proceedings, Twelfth Conference on Great Lakes Research, Ann Arbor, May 1969.

Clark, J. A.
The detection of various bacteria indicative of water pollution by a presence-absence (P-A) procedure. Canadian Journal of Microbiology 15, pp. 771-780, 1969.

Conroy, N., McGrath, R. C.
Biological effects of uranium milling wastes on stream bottom fauna in the Precambrian Shield. Seventeenth Annual Meeting of the Midwest Benthological Society, Gilbertsville, Kentucky, April 9-11, 1969.

Mickalski, M.F.P.
An investigation of daily variations in chemical, bacteriological and biological parameters at two Lake Ontario locations. Part III — Biology. Proceedings, Twelfth Conference on Great Lakes Research, Ann Arbor, May 1969.

Public Relations and Information

Cheetham, M. F.
Public Relations — The Second Oldest Profession. Industrial Wastes By-Law Enforcement Course, OWRC Laboratories, September 26, 1969.

Research

Black, S. A.
Farm Animal Waste Disposal in Ontario. 36th Annual Conference of the Canadian Institute on Pollution Control, Montreal, Quebec, October 26-29, 1969.

Boyko, B. I., Armstrong, T. D.
Treatment of Potato Processing Wastes at Salada Foods Limited, Alliston. 16th Ontario Industrial Waste Conference, June 15-18, 1969.

Boyko, B. I., Foley, P. D.
The Great Lakes as a Resource: Waste Treatment; Water Treatment. University of Toronto Great Lakes Institute, October 8, 1969.

Boyko, B. I., Murphy, K. L.
Longitudinal Mixing in Spiral Flow Aeration Tanks. Second National Symposium on Sanitary Engineering Research Development on Design, Cornell University, New York, July 1969.

Boyko, B. I., Townshend, A. R., Unsal, S.
Aerated Lagoon Design Methods — An Evaluation Based on Ontario Field Data. 24th Industrial Waste Conference, Purdue University, Indiana, May 6-8, 1969.

Harris, A. J.
New Trends in Sewage Disposal. 26th Annual Conference, Association of Ontario Mayors and Reeves, Toronto, June 25, 1969.

Harris, A. J.
Water Pollution Control Activities of the OWRC. Consumers Association of Canada, West Humber Branch, Toronto, March 4, 1969.

Oda, A.
Laboratory Evaluation of Chemical Oil Dispersants. American Petroleum Institute/FWPCA Conference on Prevention and Control of Oil Spills, New York City, December 15-17, 1969.

Vajdic, Ann H.
Virus Inactivation in Water Supplies. 4th Canadian Symposium on Water Pollution Research, McMaster University, Hamilton, February 7, 1969.

Sanitary Engineering

Barr, J. R.
Water Management in the Ottawa River Valley. Ontario Municipal Association, Renfrew, May 9, 1969.

Barr, J. R.
The role of the OWRC in Municipal Public Works. City Engineers Association Annual Fall Workshop, Niagara Falls, November 27, 1969.

Barr, J. R.
Recreational Water Quality Standards. 23rd Annual Session of the Great Lakes Park Training Institute, Indiana, February 24, 1969.

Barr, J. R.
Water Management and the Engineer. APEO-EIC-IEEE Branch Meeting, Belleville, October 6, 1969.

Kay, G. H.
Agricultural Wastes. Ontario Public Health Association Annual Meeting, Toronto, October 22, 1969.

Marsh, J. R.
The Pollution Cure. 8th Annual Lakehead Technical Professional Engineering Conference, Port Arthur, November 28, 1969.

Moore, J. A.
Ontario's Program in Water Resources Management. Fall Conference of the Erie Region of the Economic Council of Ontario, University of Western Ontario, London, October 29, 1969.

Palmer, M. D.
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